

THE SCHOOL OF SKILL:

Containing two Bookes:

The first, of the Sphere, of heauen, of the
Starres, of their Orbes, and of the Earth, &c.

The second, of the Sphericall Elements,
of the celestiaall Circles, and of their vses, &c.

Orderly set forth according to Art,
with apt Figures and proportions in
their proper places, by
* *Tho. Hill.*



AT LONDON.

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1599.

SCIENCE OF

Continued on next page

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LONDON.

710, 2015



To the Reader.

DIuers haue writtē of sundry matters in former Ages, to the intent to benefit these our later times, wherein a man can name no kind of Art or Science, liberall or mechanicall, but there are as rare wits to be found as euer liued since lerning florished. The reason is good that it should be so. For first, we haue come to our handes, vse and iudgement, whatsoeuer either antique or moderne Authors haue left behinde. Secondly, the gouernment (God be blessed) hath a long time (now these 40. yeares)

To the Reader.

bin so peaceable, that Students had neuer more libertie to looke into learning of any profession, for the inlarging of their vnderstanding. Lastly, the meanes otherwise, as well out of the vniuersities, as in them, haue been and are so many and so good, to attaine to all knowledge, that I dare be bold to say, England may compare with any Nation for number of learned men, and for variety in professions. Of late a man of good merit, named Tho. Hill, painful with his pen whiles he liued, (as the world can witnesse, being possessed of sundry his works in Print) now deceased, left this Treatise Mathematical, intituled The Rudiments of the Sphere: which being found by iudgment of the learned in the like profession, worthy the publishing, I haue, not only for the memory of the Author, but also for the profit of al well
af-

To the Reader.

affected Students, undertaken to set forth.
Wherein whosoever bestoweth time & la-
bor to read, with a temperate and sober
spirit, I doubt not but they shall be satisfi-
ed in all such points, as this Mathematician
pretendeth to handle. His stile is
not to be plausible, considering the subiect
or matter whereof he discourseth, doth re-
straine him; both to tearmes of Art, and
phrases consonant. But for his order and
facility (such as a profession of this nature
will beare) better to be conceiued, than
some (none dispraised) that haue written
of the like argument. It is not vnlike, but
he would (if God had spared him longer
life) haue held on as he began, to set forth
for the common good of his and our Coun-
try diuers necessary works. This seeming
his last, and whereof there is vse both on
Sea and Lande, printed according to his
owne

To the Reader.

owne copy, and the Figures answere able to
the patterns as they were drayne by pen,
now newly stept into the worlde, receiue &
read friendly, find no fault, but accept the
good minde of the deceased man, and
thanke them by whose meanes this booke,
which otherwise might haue beene lost, is
set on foot, and come abroad. April. 8.

1592.

Yours W. L.





THE
FIRST PART OF
THE RVDIMENTS OF
THE SPHERE OF HEAVEN,
of the Starres, of the Orbes of
the Starres, and the
EARTH.



Shewing this little Book of the Sphere
doth intreat of that part of Astro-
nomy, which sheweth the diuers
motions of the Celestiall Orbes
and Starres, the magnitudes and
distances of their bodies from the
Earth, with all the diuersities and
neerenesse of appearaunces in the
Planets, and fixed Starres : there-
fore doth the Autho^r write of the Principles of the same,
in this Treatise of the Sphere, to the great commodity of
many young Students in the Art. For this containeth
onely the intreating of the Sphere : that is, of a perfect
and very round body, containing diuers Circles, which
the learned doe also call a Materiall Sphere : of the Cele-
stiall appearances that it describeth in the Instrument,
named of them the Materiall Sphere.

The first Part

Now this teacheth five definitions of the same: two of the Sphere, one of the Center, one of the Circumference, and one of the Poles of the World.

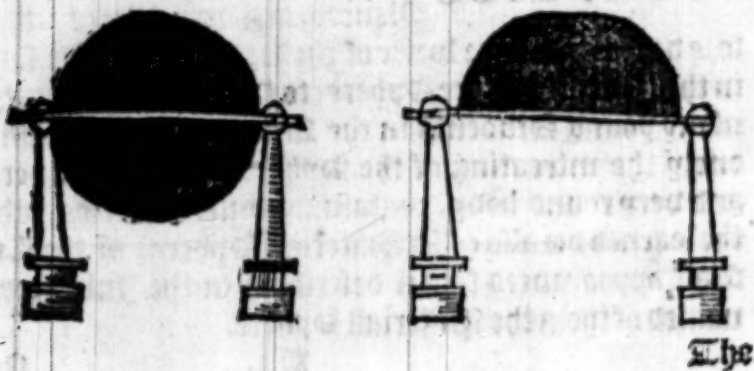
1. What a Sphere is.



VLIDE in his eleventh Booke, thus defineth a Sphere. A Sphere (which in Latine is a Globe) saith he, is a round figure, made by the turning of a halfe Circle, the Diameter of which halfe Circle continuing so long steadily, untill it be brought again unto the place, wher that figure began to be drawne.

Or thus: A Sphere is such a round and sounde body, which is described by the drawing about of the halfe Circle.

Theodosius teacheth another definition of the same: That the Sphere is a certaine massy Body, or sound figure, inclosed with an upper face or platfome, in whose middle is a Pricke, from which all lines drawn from the Circumference or platfome are equally distant one from the other: and this Pricke, of him named the Center of the Sphere; and like of the Globe.



of the Sphere.

3

The halfe Sphere is contained in the halfe of the Globe, and greatest Circle of the Sphere.

The Cre-tree of the Sphere is a right line, about which the Sphere fixed, doth the halfe Circle drawne about describe.

There are also two maner of Dybes, as the Solyde Dybe, and hollow Dybe: the Solyde is named the Globe or Sphere, which only containeth one round vpper face, and the same imbossed hollow outward: but the hollow Dybe differeth, in that the same hath two vpper faces, the one imbossed outward, and the other hollow within. Also the Dybes of all the fixed starres, and Planets, are like hollow, and not Solyde.

A materiall Sphere, is that which is made of ringes, or Circles, in such a manner framed, deuided, and dispo-



sed, that the same in some maner may expresse and shew forth to the eie, both the standing and motion of the Circles in the first mouer.

B 2

To

To the Sphere belong these differences, A Pricke, a Line, Dyametre, Parallels, an vpper face, a Center, Cre-tree, and Poles.

A Pricke or note is of no bignesse, but the beginning of Magnitudes, which in the order of nature goeth before them, and not made as a part: in that a Line is not made of Pricke, nor Pricke are the partes of a Line. For if an infinite number of Pricke were heaped and ioyned together, yet woulde those neuer make a Line: so that a Line is caused, through the drawing of a Pricke into length.

A Line, is a length without bredth and deepnesse, and ended with two prikes, which cannot be comprehended, but by Imagination.

A Dyametre, is any right line drawne by the Center of a Circle, and middle of a Figure: whether the same be plaine, Solyde, round, or cornered: whose endes reache and come from side to side of the Circle about, and deuide the Circle into two equall partes or iust halfes.

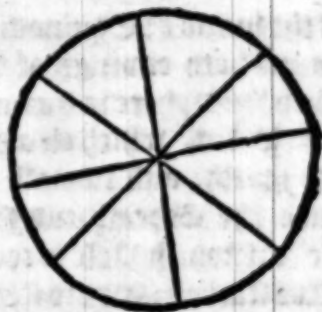
The Parallels are two right Lines equally drawne, which extended on any Platfozme vnto an infinit length, doe alwaies keepe one like distance, and neither draw nearer, nor touch together.

An vpper face, is a length and breadth without deepnesse, made by the drawing of a Line into breadth: Of which, the plaine vpper face is that, which is expessed with those straight Lines which it hath: that neither the middle riseth vpper, or is raised at the endes, nor the same falleth within. The Sphericall vpper face is distinguished, into an imbossed and hollow vpper face. The imbossed, is the outward compasse about of the Sphere, or bodies round: but the hollow vpper face, is the inwarde compasse about in the hollow Dybe, or the bodies hollow.

A Center, is the middle Pricke in a Circle, from which all right Lines drawne vnto the compasse about the same,
are

of the sphere.

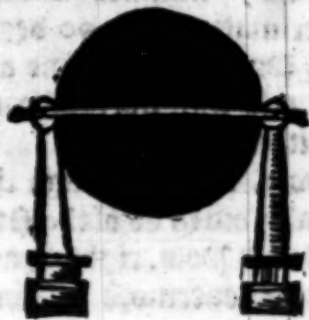
are equall betwene the one and the other. Also a Centre of the Sphere, is a middle Wycke in the Sphere, from which all right lines drawn vnto the imbossed vpper face, are agræ in length.



The Cre-træ, is a right line drawne by the Centre of the Sphere, and with both his endes pearcing vnto the sides of the imbossed vpper face, about which the Sphere is turned.

The Poles, are the verie endes of the Cre-træ, appearing on each side, about which heauen is turned. Also the Poles of the turning, are named the endes and tops, and named besides the ending pointes of the Cre-træ, drawne by the Centre of the Sphere : about which the Sphere and Circles of the Sphere are turned.

The Poles of the Sphere, and Circles described in the Sphere, are pointes consisting in the vpper face of the Sphere, from which all right lynes drawne vnto the compasses of the Circles are equall.



B.ig.

M.

Although euery greater Circle in the Sphere of the worlde hath his Poles, yet is oftner mention made of the Poles of the worlde, or Equinotiall of the Zodiacke, and Horizon.

The Poles of the worlde or Equinotiall, are the two extreame poyntes and both endings of the Gre tixe of the worlde, about which the Sphere is turned.

The one of the Poles, which eleuated sheweth to vs dwelling into the North, and turneth alwaies about in our sight, is named the Bozeall and North Pole, of the little Beare neare to it: which Pole is continually seene and knowne by the two starres neare to it; of which the one is notable and cleare, of the thirde bignesse, standing at the ende or top of the tayle of the little Beare, distant from the very Pole 4. degrees, and 9. minutes. But the other dimmer, of the fourth bignesse, not farre distant from the other star afoze, is come nearer, and doeth scarcely differ nowe 50. minutes from the place of the true and very Pole.

If any will know the Pole of the worlde or Pole starre, let him turne his face toward the North, the sky then being cleare; leauing the East on the right side, and West on the left side, and he shal see in the little Beare seauen stars, placed like to the forme of the starres of the great Beare, which are brighter. Of these stars thre doe fashion the tayle, and that which is in the top of the tayle, is named the Pole star, which declineth in our time from the Equator 85 degrees, and 52. minutes. So that beeing no further off by this declination from 90 degrees, the distance of it from the very Pole shall remaine and bee 4. degrees, and 7. minutes: and this starre also in procelle of time shall be ioyned with the Pole.

The other Pole, which through the swelling of the earth, is continually hid to vs of the North, is named the Peridionall or South Pole, right against as it were the North Pole. Beeing euermoze so lowe deppelled, as the North

North Pole rayed, in any countrey to the South, about the Horizont.

The Poles of the Zodiacke, are continually so farre distant from the Poles of the world, as is the greatest declination of the Sun, which in our time is founde and noted by obseruations to be of 23. degrees, 28. minutes, and 30. seconds. But the Bozeall or North Pole of the Zodiacke, distant from the two dimme starres, in the tryangle of the Dragon (being stars of the first bignesse) which a right line by imagination drawne from the third starre in the tayle of the little Beare, vnto that constellation named Lyra, expresseth the same, that it is but a little further distance then two degrees.

The Poles of the Horizont, are the twoe extream points or ends of the right lyne, drawne out of the Center of the Earth, by the top ouer our head, vnto the opposit places of the Dyametre of the Perydyon: of which the one, directly ouer our heade, named the verticall poynte, and of the Arabians Zenith, the other right against, named of them Nadir.

And the Poles of each of the greater Cycles, doe differ from their Circles 90. degrees, or a quarter of an other greate Circle of the Sphere. For by the 23. proposition of Theodosius of the Sphere, a right lyne drawne from the Pole of his Circle vnto the circumference, is equall to ech of the foure quarter sides, descrybed within the same Circle, which foure quarter sides, doe deuide the Circle into foure quarters.

Yet are each greater Circles of a Sphere, equall betwene the one and the other. But seeing the equall right lynes, doe take away the equall compasses of the equall Circles, therefore should a lyne drawn from the Pole vnto the circumference of his Circle, take away of the greater Circle, one quarter of the other Circle drawne by the Pole, even like as the sides of a quarter described within

he Circle. By which appeareth, that the Poles of the greater Circles, doe differ o; be distant by a quarter from their Circles, as is aboue witten.

What the World is, and into how many partes the same is deuided, with the motion of the celestiaall Orbes.



The Worlde after Orontius, is defined to bee a perfitte and an entire composition of all things: a deuine worke, but finite, and continually to be merueled at: adozned with all kindes of formes and shapes of bodies that nature coulde make, which in all partes are procreated and appeare: and those first created by God (so well in Earth as in Heauen) by his onely worke of nothing, to th'end the same might bee a proper mansion place for man, in which he might dayly behold, and make knowne.

Aristotle teacheth two definitions of the worlde: the one, that it is an apt frame wrought, consisting both of heauen and earth, and of the celestiaall and inferiour bodies aptly distributed, and of other naturall thinges in them contained.

The other definition is, that the worlde is a perfit body, and most perfit rounde forme, containing the ordinance and distribution of bodies, created by God to tend vnto a purpose, which by God, and through God is preserved.

The parts o; Regions of the worlde, are two: as the C. thereall, and Elementary.

The Etheriaall region is the higher and vpper parte of the worlde, which encloseth the Elementary region, being wholly cleare and the light perfitte, and containing the
Dys

Orbes of all the fixed starres and Planets, distinguished by a certaine order, free of all mixture and all strange qualities, nor harmed by any alterations. In which the celestiall bodies are drawne about by certaine and continuall orders and times of the motions, that they may so cause the diuersities of times, dayes, yeares, and moneths: and as well in the Elementary nature, by his motion and light, ingender, mire, and temper together the first qualities, and prepare also other effects.

The Elementary region, is the nether part of the world, which is containned within the hollowe vpper face of the Moones Orbe and Sphere, in which are all corruptible bodies, and thinges harmed by diuerse alterations, except the minde of man: the causes of which, are the contrary actions of the first qualities. Also the foure Elements are simple bodies, which into parts of diuers forms cannot be deuided: yet though the mutuall commixion of these, are diuerse kinds of bodies caused. Therefore, whatsoeuer bodies are in the Elementary region, bee either simple, mixt, or compound bodies: In that the mixt bodies, are all those which may be deuided into parts of diuerse kinds.

To these of the foure Elements, the next ioyning with, in the hollow vpper face of the Moones Orbe, is the most thinne Ayre (being the lightest of the Elements) kindled, though the dayly moving about of the celestiall circles: which for this congruency with the fire (named the elemental fire) that is dayly drawn about by the Orbes compassing it, which may appeare by the Comettes, and other fiery kindes, ingendered in the same Element of a hot and dry vapoure, that are likewise caried about.

The next within that doth the ayre runne, being a heavier Element then the fire, yet lighter then the water: which also is drawne about by a like motion, as may appeare by the clouds, and other like impressions ingendered in the same, but to the nether region of the same, consist the late:

The first Part

laterall motions, as we dayly see by the blowing of the windes. Further, Vitellio in his tenth booke and 60. chapter affirmeth, that the cloudes are distant from the vpper face of the earth 25000. paces, or 13. Germane myles. But according to some writers, they are vnequally distant from the earth: as somewhyles further off, and somewhyles nearer to the earth. For when the cloudes are furthest distant from the earth, they are but 772000. paces, and being nearest the earth, are 288000. paces distant. To conclude, this Clemente compasseth and encloseth, both the earth and water by his largenesse.

The next Clement to the Ayre which mooueth, is the water, for the same is moued by a motion of flowing and ebbing which it maketh after the motion of the moone; in that it floweth sixe houres, and ebbeth so many, vntill the moone by the motion of the first mouer, hath passed about all the quarters of heauen. Also the water hath a motion, and that downward into the earth, so that these two ioyned together make as it were one body. Yet the earth being the heauiest Clemente, hath a motion attributed as it were simply downwarde vnto the middle: notwithstanding agreed of all men, that the same is immouable, and the Centre of the world.

These foure: that is, the fire, ayre, water, and earth, are named to be the foure Elements, and both the simple, and Original matters, of which all mixt bodies are compounded and made.

The proofe that there is onely foure Elements, is this: that to each Clement the two first qualities agree, and the Combynations the like of the foure qualities: as of heate and dryeth, which consist in the fire: of moisture and heat, which rest in the ayre: of coldnesse and moisture, which be in the water: of drynesse & coldnesse, which is found in the earth.

By these it is euident, that there are but foure Elements,

ments: of which heate excēdeth in the fire, moyſture in the ayre, coldneſſe in the water, and dryneſſe in the earth. To conclude, it appeareth, that heat with colde, and moyſture with dryeth, cannot aptly be ioyned.

What the Starres are, and that, as to the motion of their Orbes, they are carried about.

THe Ethereall region containeth the Starres, which are the thicker parts of their Orbes; perfit rounde, cleare, moſt pure and ſimple, and free of any mixture, except the Spot which is darker then the others, yea variable and ſhadowed. And theſe faſtened to their Orbes, by which in certayne continuall and appoynted times and orders, are drawne about, and perſorme their returnes in the determinate ſpaces of times, and thoſe continually agreeing in themſelves, that they may ſo ingender the differences and orders of times, and in the inferiour nature prepare and cauſe the firſt qualities, and other effects.

The Sunne the fountaine of light, doth not onely giue light and make ſhine cleare the inferiour bodies, but the ſuperiour alſo, by the brightneſſe and light of his beames.

But the Stars ſeing with a borrowed light they ſhine, which is far weaker then the ſunnes, therefore with that ſtrange light which they take properly of the ſun doe they ſhine, although unlike to the ſun.

For into all the Starres, which by nature are rounde about thynne, and penetrable, is the ſunnes light equally ſhed and pearceth, and ſo filleth all, that they are ſubiect to no times of encreaſing and decreaſing of light.

But

The first Part

But the Moone, seeing it is an vnperfitt body, and that it hath the partes some where thynne, & somewhere thicker and better compact: therfore doth it not equally, noz round about receiue the sunnes light. So that the thynner parts take more of the sunnes light, and of the same doe clearer shine. But the lesser shadowed parts which also are seene, appeare darker, as the spots in the moone do shew.

That the bodies of the starres are round, doe the round formes in the Eclipses of the sun and moone shew: yea in what parts of the world those Eclipses happen, doe the bodies also of the starres at that time appeare perfitt round: Although the bodies of the starres be knowne (by sundry reasons) to be round as a bowl, yet by their great distance from the earth, appeare to vs as playne or flat.

For the Starres are not moued by their owne proper motions, but by the Accydentary, as vnto the motion of the Dybs, to which they hang, as partes vnto the motion of the whole. For to euery round body doe two proper motions onely belong, as a moning to and fro, and turning about. Therefore the Starres (seeing they be round) are by some proper and principall motion caried round. But the fixed Stars are not so moued rounde, in that they turned about, doe not altair the same face or body which they once turned and shewed to vs: but that the same shoulde of necessity happen like, being turned round in one place, about their Centre, with the others in the same motion being in the parts far distant, and the others then set and hidde vnder the earth. For are they turned hither and thither, in that they neuer change the standing and place which they haue in their Dybe, which to those caried hither and thither woulde happen. Therefore, not by a proper and chiefe motion are they caried about, but by an accidentary drawing about of their Dybes, which what the same is, shall after appeare.

That

That Heauen is drawne round.

The Ethereal region, do the Philo-
sophers also name *quinta essentia*, or
as it were a fiftie body, constituted
about the foure Clementes, being
incoꝛruptible & deuine, consisting
of the noblest and purest part of the
ayze. Which also is placed about
the holow vpper face of the moones
Dybe, that reacheth vnto the hol-
low vpper face of the highest heauen, being most pure, per-
fite rounde, continually caried about, and bright appea-
ring.

This parte of the world being the Etheriall region, is
named heauen, which alwaies drawne about by a merue-
lous swiftnesse, is deuided into nine Dybes or Spheres.
Although sundry Astronomers, as Alphonsus, Iohannes de
monte regio, Purbachius, and others, haue added a tenth
Sphere, though the third contrary motion founde in the
eighth Sphere, named of Thebit benchore (the first inuen-
ter of the same) (*Motus trepidationis*, or the going and com-
ming of the eight Sphere.

The first and vppermost Dybe, is named the first mo-
uer. The second is that, which is named the ninth Sphere
or Chyistaline heauen, but of Ptholomy, named the firma-
ment or Dybe of the fired starres. And the thirde is that,
which (of them) named the eight Sphere, onely added
through that motion of the trembling, or as it were a mo-
ning forth and returne of that eight Sphere; which pro-
perly is caused, in the two small Circles about the heades
or beginnings of Aries and Libra: through which diuerse
motion of the eight Sphere, do the Equinoctials and Sol-
stices

stices come and beginne sooner by certaine daies, and the suns greatest declination diminished (and dayly doeth) to that in Ptholomie and Hipparcus time, which then was 23. degrees and 52. minutes, and 30. seconds. And soe these haue Alphonsus and sundry others attributed diuers motions to the eight Sphere, adding a ninth and tenth Sphere to it.

That there are but eight celestiall
Orbs which may be scene.



Although Ptholomy affirmeth, that there are nyne Orbs equally distant, yet are there but eight which may perfectly be scene and decerned with the eie, both in the standing, variety of motions, and differing in the periodes or courses. Also they are in such order disposed, that no Orbe hindereth the motion of another nere to it. As the Sphere of the fixed stars, and the seauen Orbs of the Planets. And most certaine it is, that some of the fixed stars are dzaton by a swifter motion, and others by a slower motion, and that the Apogea or ascentions also of the Planets are changed, after the order of the signes.

The Orbs of the Planets thus containe and compasse one an other, as first the Sphere of Saturne being nighest the firmament (of which being compassed) doeth like containe Iupiters sphere, and Iupiters, doth in the same maner inclose Marses sphere, and Marses in like order, the sunnes sphere, nerte the suns, doeth containe Venus sphere, which like doth compasse, Mercuries sphere, and Mercuries doeth containe the Moones sphere, being the lowest and smallest sphere. And euery of these spheres, hath a star a pcece, named

med erratical Stars or planets: which Stars haue enery one their proper Dybe feueral, his motion feueral, and vnlke in time one to another, in that they appeare one whiles nere together, and another whiles are scene far distant a funder.

By which it agræth, that their equall motions, to appeare to vs vnequall, either through the Poles of the Circles, diuers from the Poles of the worlde about which they be turned, as are the Poles of the Zodiacke, vnder which the erratical Stars are continually drawn and moue; rather for that the earth is not the Center of those Dybes, by which the Planets are caried and moued about.

So that when we consider those mouings by the Center of the worlde, then is caused, that they seeme to vs as they were encreased in a greater bignesse, when as we behold and see them nere hand, and that lesser in bignesse, when we see them placed far off. Euen so in the equal circumferences of the Dybes, through the diuers distance of sight, we like obserue the vnequall motions, by the equall times.

Yet indeede neyther of these happeneth, but that they are drawn about by vchangeable spaces, being a like distant, and keeping one manner of bignesse. For if this were, then the sun, or any other star being in the middle of heauen, should seeme or appeare bigger (which it doth not) then being in the East, or West part.

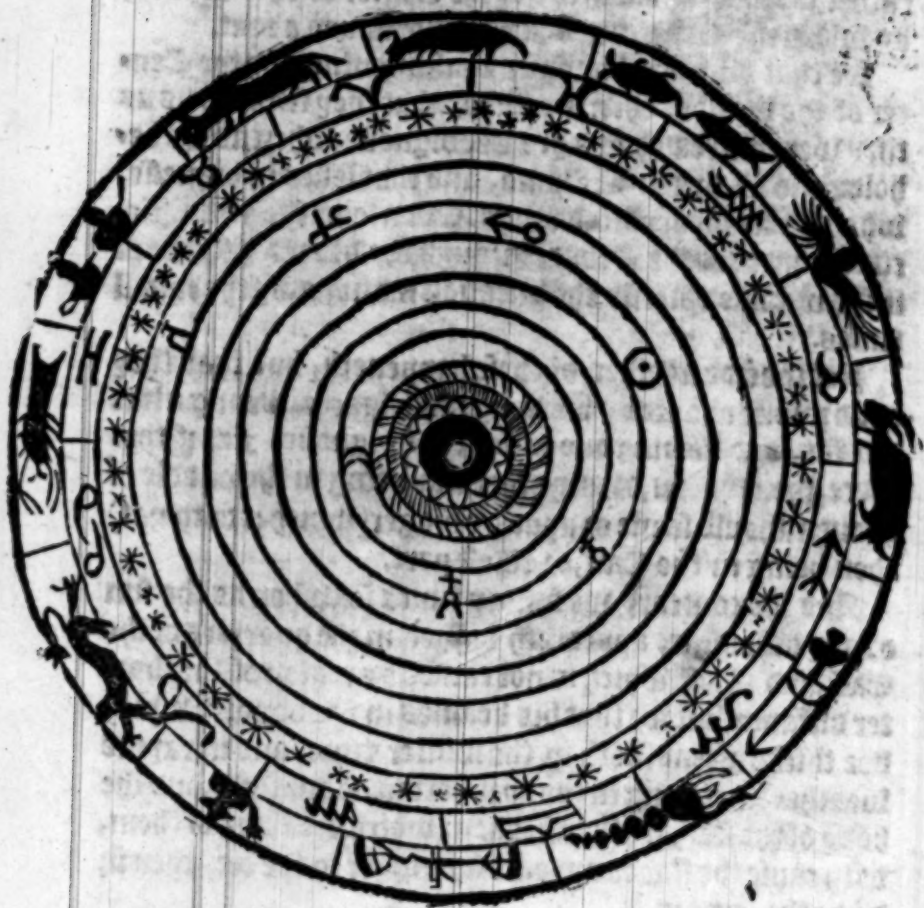
And the contrary we sundry times see, when as the sun or any other star, appeareth bigger in the quarters of the East, and West; which is not caused by reason of the shorter distance, but for that his beames in the vapors, which doe thicke ascend (both in the winter time, and in raynie weather) that hang in the ayre betwene our sight, and the body of the star, are then broken: which breaking of them, doth cause the star to appeare far bigger to the eye, then in deede the same is.

And

The first Part

And that a readier and easier knowledge may bee had (after the mind of Ptholomie) of the first moouer, and celestiall Dybs with the number of the Circles and Elements inclosed within the first moouer, conceive this figure here following most aptly drawn and set out for thy further instruction.

This Figure declareth the number, disposition, and order of the celestiall Spheres, about the Globe of the Earth.



That

That there are two first motions
of the celestiaall Orbs.



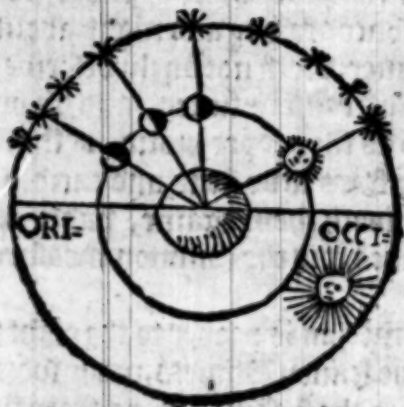
Although the celestiaall Orbs are seuerally drawne, by proper and vnlike motions: yet be there two first motions, that are manifest, both by obseruation, and iudgement of the eye. The one is of the first mouer, which Ptholomy attributeth to the ninth Sphere, that is onely drawn about by an equall swiftnesse, from the East into the west, and from thence againe into the East, vpon the Poles of the worlde or Equatour, in the space of a naturall day or 24. houres. And this first mouer draweth with it al the other Orbs, much like a ship, which being at full saile, doth drawe and cary al her men, & other liuing things which are in the Shippe. So that by this motion of the first mouer, the neather Orbes, which the first mouer compasseth, are drawn once euery naturall day, or in the space of a day and night, about the earth. Also this first mouer, doeth not onely describe and measure a naturall day, but causeth times, and diuersities of dayes and nights, with the proper motion of the sun; and it daily bringeth vp stars to be seene, and carieth vp to the highest, and after hideth them againe, vnder our Horizon in the west. Besides it is the common measure of al the other motions.

The other motion is proper to the eight Sphere, and to the Orbs of the seauen Planets, in the which they are contrarily caried to the first mouer, as from the west into the east, in mouing vnder the Zodiacke, and about the Poles of the same: and not in Parallels from the Equatour equally seperated; but are drawne much slower, yea and vnlike. As by a like example; when a ship by a most swift

C. i.

course

course is caried into the west, yet may the Mariners and others in the ship walke so: waide in the meane time into the East: Euen so is this second motion of all the other Spheres vnder the Zodiack, vpon the Poles of the Eccipticke. Also by a swifter motion are they caried, and swoner perfoyme their courses, which are neerer to the earth, and contrariwise moone by a slower pace, and in longer tyme. & compasse and wander aboute the signes of the Zodiacke, which are further distant from the earth. Also in the middle of their courses (as it were) each doe often slacke or bee slow, and often times stay as vnmoueable, and sometimes are retrograde, after againe quicken their course, and by their swiftnes recouer that lost of the former tariance. So that they neuer keepe one manner of way, but one whiles from the middle iourney of the Zodiacke doe wander into the North, and another whiles into the South. To conclude, they be ascended high from the earth, when they are named Apogei, and discended again vnto the earth, when they are named Perigei.



That

That there are two kindes of

Starres, the fixed, and the
Planets.



All the fixed stars that hang to the firmament, or as Ptholomie affirmeth to the eight Sphere, are named fixed: not so that they consist in moueable, but that they moue so meruellous slow, that by iudgement of the eye they cannot be perceived to moue: yet the practitioners haue and do find both by reason and obseruations, that they alwaies seperated by in-moueable spaces one from the other, and are caried in parallels as it were in their Orbe.

Ptholomie, Aristillus, Timochares, with the obseruations of Hipparchus, ioyned vnto those which he knew, noted that the fixed stars in a hundredth yeeres moued one degree. But Copernicus being of later yeeres (as about the yeare of Christ 1525.) that examined the obseruations of the auncient men, and compared them vnto those noted of him, founde that not so many as a hundredth yeeres, but in seauentie and two yeeres, that the fixed had gone one degree: and that in euery Egyptian yeare (which containeth 360. dayes) the fixed to haue moued 50. seconds, and in a day 8. thirdes, and tenne fourths. And so perfozmed their whole course, in twentyfine thousand, eight hundredth, and sixtene yeeres, 25816.

Of these knowne and numbzed of the ancient men, are 1022. which they haue deuided into sixe differences of magnitudes; and to these haue added certaine obscure, and certaine cloudy stars.

The fixed stars of the first bignesse, of which are num-
C y. bzed

bzed to be fiftene, and that both in bignesse and brightnes exceede all the other starres, and in body exceede the earth 107. that is, a hundredeth seauen times, with a eleuen th; & scoze fourths.

The fired stars of the second bignesse, of which are accounted 45. do exceede the earth in greatnes almost eighty seauen times.

The fired stars of the third bignesse, of which are numbered to be 208. doe ouerpasse or exceede the earth seauenty two times, with a third part almost.

The fired stars of the fourth bignesse, of which are reckoned to be 474. that are fifty foure times greater then the Earth, with a halfe or a little more of the earth.

The fired stars of the fift bignesse, of which are noted to bee 216. that exceede by their greatnesse the earth 31. times.

The fired starres of the sixt bignesse, of which are noted to be 50. doe exceede the earth eightene times, and a little more.

The darke stars, are accounted 3. in number: and the cloudy stars, are reckoned to be five.

The fired stars do differ in brightnesse, standing, color, twinkling, and especially in the configuration. Many of the fired stars also with the effects both in the bignesse and brightnesse, being notable and nere together, the ancient men that deuided them by a certaine reason, haue gathered, digested, and fashioned them, into forty and eight images or similitudes. And vnto them through the congruence and similitude of the noted formes or figures, they gaue apt names: and for the same cause especially, that they might the easier and sooner be discerned, knowne, and noted by their peculiar names. Also they deuided the stars, by the standing into the North and South, and the signes of the Zodiacke. The Northerly stars that decline from the Ecclypticke into the North, are twenty and one in num-

6 The image Virgo hath 26. stars: of these, that which is in the right wing, especially northerly, is named Vindenuator, but in her left hand a bright star, named the ear of coꝛne, 6. without foꝛme.

7 The image Libra, and knees of the Scorpion, haue 8. stars, and 9. without foꝛme.

8 The image named the Scorpion, hath 21. stars, the midle star (of the thꝛe stars) placed on the Body, is named the heart of the Scorpion, and 3. without foꝛme.

9 The image named Sagitarius, hath 31. stars.

10 The image named Capricornus, hath 28. stars.

11 The image named Aquarius, hath 24. stars, and 3. without foꝛme.

12 The images named Pisces, haue 34. stars.

The Summe of all the Starres, except Berenices bush, are 364.

Of the Southerly.

1 The image named Coetus, hath 22. stars.



2 The image named Orion, hath 38. stars.

3 The image named the riuer, oꝛ Eridanus, oꝛ Potamos, hath 34. stars.

4 The image named the Hare, hath 12. stars.

5 The image named the Dog, hath 18. stars, of which that in the mouth, is named Alhabor, 12. without foꝛme.

6 The image named the little Dog, oꝛ Caniculare star, hath 2. stars; of which the brightest is that named Proion oꝛ the Dog-starre.

7 The image named the Ship, hath 45. stars, of which a bright star going before in remone.

8 The image named the Water Serpent, hath 25. stars and

and 2. without forme.

9 The image named the Bucket or great Cup, hath 7. starres.

10 The Rauen or Crow, hath 7. stars.

11 The image named Centaurus, being one halfe like a man, and the other halfe like a horse, hath 37. stars.

12 The Beast which the Centaure doth holde, being a Wolfe, hath 19. stars.

13 The image named the Aulter, hath 7. stars.

14 The Southerly Crowne, hath 13. stars.

15 The Southerly fish, hath 11. stars, and 6. without forme.

The Summe of all the starres, are 316.

The milkie way, which Ptholomie nameth Galaxian of the white and milkie colour, is a heape of most small stars, and dimme to sight; of which is a certaine confused gathering together, and abundance as it were encreased, that no seuerall light is decerned: and the same (in the manner of a girdle) compasseth and encloseth heauen about. The same also is vnequal, and differeth in the standing, latitude, haunt of stars, and in the colour very much. It is somewhere decerned cleft, but the parte going before, is neither whole, nor maketh a whole swathe or inclosure about, but lacketh about the Swan and Aulter. And the part folowing whole, being in no place broken off with a space, and stretched thwartly in heauen: and from the partes of the Zodiacke Northerly, it passeth by Gemini, and Southerly by Sagitarius, and Capricornus.

number. The Southerly, that decline from the Eccлип-
ticke into the South, are fiftene in number. The images
that are named the signes, are twelue in number, which
consist in the Zodiacke.

Of the celestiall Images, and of their
diuers names, being in num-
ber, 48.

Of the Northerly.



The little Beare hath seven stars,
and of those, that star which is
in the top of the tayle, is named
the Pole star.

2 The great Beare, hath 27
stars, 8 without forme.

3 The Draggon hath 31.
stars.

4 The image named Cephe-
us, hath 12 stars.

5 The image Bootes or Lauceator, hath 22 stars.

6 The Bozeall or Southerly crowne hath 8. stars.

7 The image kneeling or Hercules, hath 28 stars.

8 The Harpe or Griep falling, hath 10. among these
the brightest is that named the Harpe.

9 The wilde Swanne or Griep flying, hath 17.

10 The image Cassiopia, hath 12. stars.

11 The image Perseus carrying the heade Algoll, hath
26. stars: of which, those which are on the lefte hande doe
make the head Algoll or Gorgons, 3. without forme.

12 The Cartare, hath 14. starres, among those, that
which standeth on the lefte shoulder, is the Goate: and the
other two are named the Kids.


C ij.

13 The

- 13 The image Ophiulcus or Serpentarius, hath 24. stars.
 14 The Serpent, hath 11. stars.
 15 The figure named the Arrow, hath 5. stars.
 16 The Eagle hath 9. stars, 6. without forme.
 17 The Dolphin, hath 10. stars.
 18 The deuision of the Horle, hath 4. stars.
 19 The winged Horle or Pegasus, hath 20. stars.
 20 The image Andromeda, hath 23. stars.
 21 The Tryangle, hath 4. stars.

The Summe of all the Starres, are 360

The 12. Signes of the Zodiacke.

- 1  The image named Aries hath 13. stars.
 2 The image Taurus hath 23. of these five in the fore-head of Taurus, named Succula or Hiades, and the greatest star of Hiades in the Southerly eye, named Pallilicium, and Pleiades on the back of Taurus, 11. without

forme.

- 3 The images named Gemini, are 18. stars: of which Castor or Appollo goeth before, Pollux or Hercules, followeth.

- 4 The image Cancer hath 9. stars, among these Prespe, and the cloudie star in the Breast.

- 5 The image Leo hath 27. stars: of these, that which is in the heart of the Lion, named Regulus, 8. without forme; among which is that constellation, named Berenices bush of haire, betwene the tops or endes of the Lion and great Beare.

6 The

but the lowest poynt of the sunnes Dybe, is from the earth distant 1065. semidiametres.

Venus next to the Sun, being cold and moist, white in colour, clearer and brighter shining then Iupiter, and is caried about (like the Sun) in a yeares space, and both goeth before and foloweth the sun; nor is further distant in the spring of the morning from him, then 46. degrees, and 47. minutes: but in the evening, she is some digressed from him, unto 47. degrees, and 35. minutes. When she goeth in the morning before the sun, she is named the day star: but when she foloweth the sun in the evening, she is then named the evening star. Lesser shee is then the earth, but her true quantity is yet unknowne: for that some affirme her quantity to be the 28. part, and others the 37. part of the earth. The highest ascention of Venus Sphere, that obtaineth the 18. degree, & 20. minutes of Taurus, is from the earth after Albategnius 1070. semidiametres, but the lowest poynt, is 166. semidiametres distant from the earth.

Mercurie beeing lower then Venus, is variable and apte to be changed, bright, but not white in colour; and is caried about the sunne like to Venus, as one whiles moving before, and an other whiles following the sunne. For is he further distant in the morning from him, then 29. degrees, and 37. minutes, and at the evening westwarde, 27. degrees, and 37. minutes. He perfourmeth his whole course, in the space of a yere, as the sun doth. Also he is iudged to be the seauenth part of 27. or 22000. parte of the earth. Albategnius affirmeth, the Star of Mercurie, to be least of all the starres, and supposeth or accounteth him to be as one part, of 19000. parts of the earth. The highest ascention of Mercuries Sphere is from the earth after Albategnius) distant 166. semidiametres, but the lowest point in the same Dybe, is 56. semidiametres distant from the earth.

The

The Moone being lowest of all the Planets, doth compass about the whole Zodiack, in 27. dayes, 7. hours 43. minutes, and 7. seconds. She is lesser then the earth (after the iudgement of Ptholomie) by thre hundredeth nine times, and a vnity more then eight parts. For the triple proportion of the diametre of the earth vnto the moone, by diuiding about the fift parts, is euen the like, as 27. vnto 5. But lesser she is then the sun, by sixe thousand, five hundredeth, thirty and nine times. Copernicus (by his obseruations) founde the earth greater then the Moone, by forty thre times: lesse then an eight part: and of this, the sunne also is founde greater then the moone, by seauen thousand parts, lacking thre score seconds. And the greatest distance of the new and full moone from the earth: after the mind of Ptholomie, is 64. semidiametres, and 10. scruples: but after later obseruations, 65. semidiametres, and 30. scruples. And the lowest to the earth, is 55. semidiametres, and 8. minutes.

The Moone digressing from the Sun euery moneth, and taking o2 receiuing a newe light as it were, in that she (is changed, & taketh a new light of the sun) doeth after encrease by little and litle, conceiuing dayly a bigger forme and light, vntill shee come in right line against the sunne; at what time she shineth with full light: after returning againe vnto the sun, she waxeth olde by losing of her light by little and little: and in the contrary maner cometh vnto the like formes of light, vntil she comming vnder the beames of the sun, be quite out of sight. Also for that the moone hath a body, partly thin, partly thicke, solyde, and shadowed; therefore is she not equally filled round about with the beames of the sun, but that the same halfe of her Globe o2 body, which turned againe in heauen (that be holdeth the sun) is it which shineth, and the other halfe turned away from the suns light, is that which shineth not, but remaineth shadowed.

That

Of the Planets.

The Planets, named otherwise the erring and wandering starres; not for that they erre by a wandering and vncertaine motion, but in that they are caried aboute by a diuers and vnlike motion. For sometimes they goe forward, and sometimes retrograde; sometimes are hidden and cleane out of sight, after they appear and shew themselves. Againe, they goe before, and follow the Sun. They are caried swift, and their motions againe so stayed, that they are moued in a maner nothing at all, but seeme as they were stayed for a time. From the sunnes way, one while caried into the South, and another while caried into the North, and then vnto the same way drawne backe againe: so that their iourneies being passed and finished, they steadily repeate their old courses by the like order. Of these are seauen, and each caried in their proper Dybs, and compasse about the Zodiacke, in vnlike spaces of time,

Saturne highest of the Planets, and most slow in course, being cold and dry, pale to a leady colour, and perfourmeth his course in 30. yeres, being ninty times, with an eight part greater then the earth. And the highest ascention or pointe of Saturnus Dybe (which at this day is in the 29. degree of Sagitarius) is from the earth 20072. semidia- metres, with a fourth part almost, and 15. minutes. But the lowest point of Saturns Dybe, is distant from the earth, 14378. with a third part, and 20. minutes.

Iupiter

Iupiter being next vnto Saturne, temperate, and so cleare
 102 bright, that he giueth in a maner a shadow (especially
 when he is Perigeus 02 lowest discended to the earthward)
 and he compasseth about the Zodiacke in twelue yeares.
 But Iupiter giueth this proper shadowe, when neither the
 lights bee aboue the earth, no2 Venus nere to him. He is
 greater then the earth, by ninty five times, and a half part
 almost. And the highest ascention of Iupiters Dybe, which
 possesseth the seauenth degre of Libra, is from the earth
 14369. with a fourth parte almost, and 15. minutes, but
 the lowest point of Iupiters Dybe, is from the earth distant
 8853. semidiametres, with a ninth part and 45. minutes.

Mars being hot and dry, and shining with a fiery co-
 lour, doeth goe about the Zodiacke, in the space of
 two yeeres. He is named the fiery Planet, of his shining
 with a fiery colour, 02 of the effect which foloweth by him,
 in that he burneth and dryeth vp. He is one time greater
 then the earth, and a little more then a third parte. The
 highest ascention of Marcs Dybe, that obtaineth the 28.
 degre of Leo, is now distant (after Albategnius) from the
 earth 8022. semidiametres: but the lowest poynt from the
 earth, is 1176. semidiametres.

The Sunne obtaineth the middle place betwene the
 Planets, wholly and thoroughly bright, being the foun-
 taine and Autho2 of light: which by his motion expresseth
 and denideth the spaces of the Zodiacke, and by his going
 about, haue the signes their names. He is greater then
 the earth (after Ptholomie) a hundred threescore and five
 times, with thre eight parts. But after Capernicus, the
 sun exceedeth the earth, a hundred threescore & two times,
 with eight parts lesse. The highest ascention 02 poynte of
 the suns Sphere, which now possesseth the seuenth degre
 of Cancer, is from the earth distant 1179. semidiametres,
 but

That Heauen hath a round fourme and
to be carried circularly.



First, heauen is equally distant round
about from the earth, and of this is
heauen perfect rounde, after the de-
finition of the Sphere. Which rea-
son is thus proued; that if heauen
shoulde haue any other forme then
perfect round, then of necessity must
the stars change their distances frō
the earth, what place vppon earth
they shoulde purchase, as somewhere more, and some-
where lesse they shoulde bee distant; and the standing of
them changed, shoulde also alter their apparant bignes-
se, in that they shoulde appeare greater being seene nēre hande,
and lesser, being seene far off. Yet neither of these hap-
peth, but that they cōtinuallly keeping a sūnder, are dꝛawn
about by vñchangeable spaces, and holding a like bignes-
se and distance, to all places of the earth.

That the stars about the quarters of the East or West,
appeare sometimes greater, is not caused by reason of the
shorter distance, but soꝛ that their beams in the vapours,
which often times consist in the ayze betwēne the starres
and our eie, are then broken; which breaking of them, cau-
seth the body of the star seene, to appeare much greater in
the eie, then in deed it is.



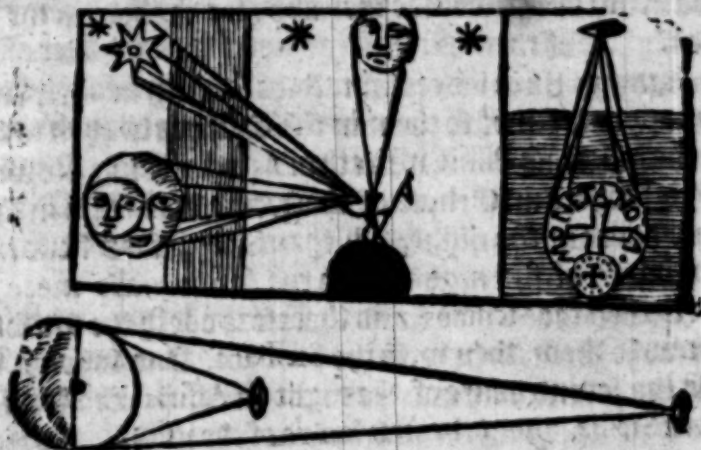
That heauen is drawne circularly, is thus knowne; in that wee alwaies see all the Stars, from the East into the West, to be drawne vpward, and that the hemisphere in our sight, is carried continually in distant cyrcles equidistant, neuer changing the standing or distance, one from another, neither in bignesle, as far as the iudgement of the eie can descerne, neither any whit lessened. For they being drawne from the neather place (as from the earth) are carried by little and little. And after they be thus come vnto the highest of their iourney (as vnto the noon-sterre) they decline again by little and little, till they be brought down vnto the west quarter, and there set and hidden, vnder the earth: and these places and times, both of the risings and settings doe they repeate in certaine order. Therefore by these it appeareth, that they are drawne and carried by round.

By the second it is euident, that the Starres, which be nere the Pole Arctike, are neuer hidden out of our sight, but are continually and vniformally drawn round about the Pole as the Centre: in such sort, that the stars neare to it make the lesser compasses, and the stars further off, doe define greater compasses. So that the starres fastened to their proper Orbs (as aforesayd) are circularly carried. By which two motions of the stars, as well tending vnto the West, as otherwise; it plainly appeareth that heauen is drawn about and carried round.

A manifest demonstration appeareth of the former argument, by this figure here following.



That the Water and Earth are round Bodies, and by a mutuall embracing doe make one Body, and one hollow vpper face,



That the earth is round, is thus proved. Whereas in every vpper face, the length and breadth is considered. The length of the vpper face of the earth, is from the West, into the East, or contrariwise. The breadth is from the South, into the North, or contrariwise. That the earth also to be rounde, appeareth after length: in that the Sun, Moone, and Stars, doe neither arise, nor set at one instant time alike, to all persons dwelling in any parte of the earth. But doe much sooner appeare and shine to them dwelling vnto the East, and within a whiles after they shewe to them dwelling in the West.

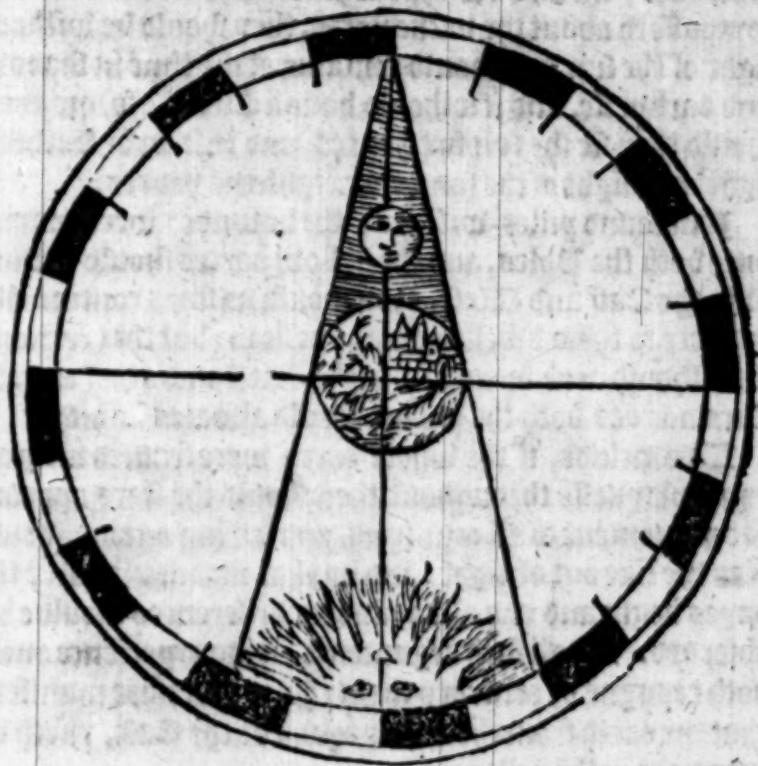
By the second appeareth, that one and the like Eclipse
of

of the moone in diuers houres, is seen both in the East and West. For that which appeareth in the first houre of the night to them in the West, is scene to them in the East parte, in the second, thirde, or fourth houre, euen as they come nearer vnto the East: which would not be caused, if the night to both places should happen and bee at one moment, nor sooner woulde they appeare to them in the East part.

Againe, there bee certaine stars, which in their rising, doe appeare sooner to them in the East parts, then to them in the West, as Plinie writeth of Arbelis (being a towne in Asiria) where an Eclipse of the Moone was scene in the second houre of the night, which in Sicily, was scene in the first houre of the night. For the Assirians are more Easterly then the Sicilians, and therefore doeth the sun set sooner with them, then with the Sicilians. And when it was also the second houre of the night in Assiria, the Sun first set in Sicilia, about the first houre of the night. Moreover the Pole of the world (according to the diuersitie of places) is eleuated and depressed. So that the cause of the diuersity of this appearance, is onely the swelling of the earth.

To be brieue, the beginnings and spaces of the dayes and nights, and that in diuers places of the earth do vary, and yet following in a maner, one order. But this variety could not happen, if the earth were not Sphericall, and all about equally rounde, herein excluding both vallies, and the toppes of hilles, which applied (vnto the body of the earth) cause no inequalitye or diuersity at all. For the swelling of the earth causeth, that the stars be not scene together in all countries, but drawne about by little and little, by a certaine succession and order, that they so appeare sooner to them in the East part, then to them in the West, though the swelling as yet not aboue caried, which swelling being high betwene both, is a let and cause of the later appearing of them to the west: and by that meanes al-
so

so keepeth and hideth the stars the longer from their sight.
So that by these it evidently appeareth, that the onely
cause, is the swelling of the earth.



If the earth were fashioned with a deepe hollownesse,
and compassed round about with a light inclosure, then
should the stars risen, be soonest sene to them in the West
partes, and much later appeare to them in the East. For
that the higher inclosure to the hollownesse, as a wal built
about, should be a let and hinderance to the sight of the be-
holders; in such sort, that those starres arising, it shoulde
hinder their sight.

If the earth were formed with places standing in sharp
piller forme, or in right line vp; then should the stars ap-
peare

peare set, and be hidden alike to those places, and no differences of dayes should be caused, but that they should haue one like day, and the sun also appearing to that side, which they shewep: so that whiles the Sun runneth and compasseth about the backe parts, they should be without light of the sun, and should remaine al the time in shadow and darknesse. And if it should haue a Cubicke forme, then should they see the sun sixe houres, and lose or be without light and sight of the sun, other eightene houres.

If in round piller-wise, as if the howndes were playne vnto both the Poles, and the hollow partes should decline vnto the East and West, then should no stars continually appeare to them dwelling in the hollow: but that certaine stars should arise vp and set in the West, and other certaine stars nere to both the Poles, should allwaies be hid.

To conclude, if the whole earth were framed with an equal playnesse throughout, then should the stars appeare at one moment to all countries; and setting againe, should hide the like out of sight: and by that meanes should the dayes begin and end alike, and no differences should be obserued. To all such arguments, seing experience onely doth repugne or contrary them: It is therefore manifest, that the earth from the West towarde the East, riseth vp into an equall swelling.

If the earth also were plaine from the East vnto the West, then should the starres arise so sone to them in the West, as to those of the East, which is a manifest error. Also, if the earth were playne, from the North vnto the South; and like from the South vnto the North: then the starres which were to some of a continuall appearance, should allwaies seeme the same and like, which way or into what quarter soener a man goeth, which also is untrue. But the cause which maketh the earth seeme plaine, is through the ouer great quantity, which causeth it so to appeare to euery mans sight.

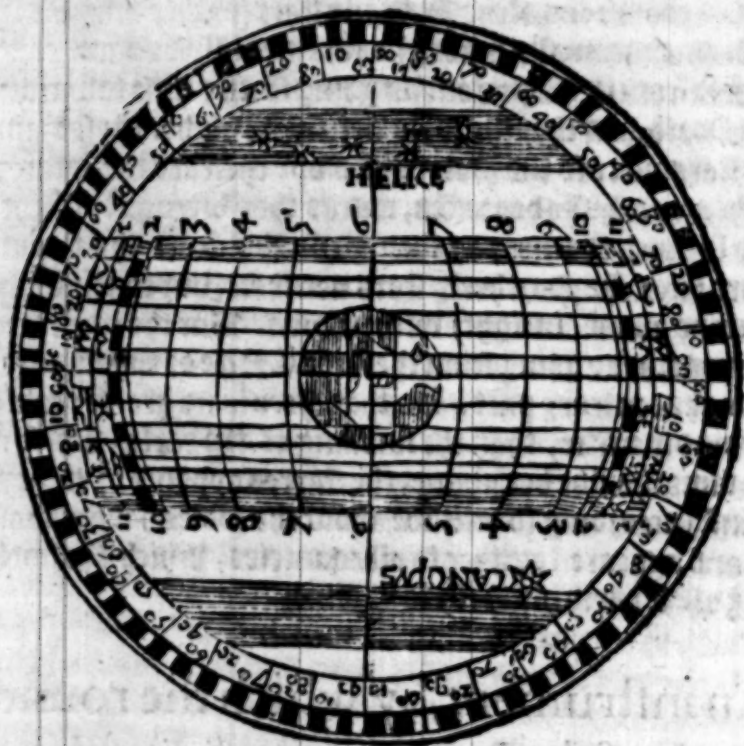
But

But that the earth is round (according to latitude) the diuers eleuations of the Pole and Stars (eyther alwaies in sight, or continually hidden) both evidently declare.

For from the Equator, in going forth easilie towardes North, and that the Pole Articke be higher rayfed, and the stars nere to the Pole rayfed vp; then are the Stars right against like depressed, and as they were out of sight, and so much the more as they go further from the Equatour: nor the Northerly Stars neuer set, but continually dravne about (in sight) with heauen. But the contrarie happeneth, by going from the saide Cycle or Equatour, vnto the contrary part. So that there is no greater cause of this diuersitie, than the swelling of the earth, which if the same shoulde bee plaine, the starres opposite or right against (according to latitude about the Poles) shoulde offer and appeare together to all countries, which the swelling of the earth hindzeth to be seene.

An instrument, by which the roundnesse of the Earth (according to latitude) may be proued, and all those may easily be shewed which are taught of the dayes Artificiall.

That



That the Water hath a like swelling,
and runneth round.



his by two reasons is proued, the first is most certaine, by a mark or marks standing on the sea banke, like as a towler, steeple, or such like erected of purpose, so that a shippe sayling into the deepe, and carried so far off, that no more of the sides or bottom can be discerned, sauing the top of the mast, which only appeareth

peareth to the sight. And thus, that a marke stode on the sea banke, and a ship passing forth of the haven, sayling so far into the sea, that the eie of the beholder being nere the foote of the mast cannot decerne the marke (the ship in the meane time staying or standing still) so that his eie being in the top of the mast, shall perfectly see that marke: but the others eie being nere the foote of the mast, shoulde rather better see the marke, than he which is in the top of the mast, as may moze evidently appeare, by lynes drawne from either place vnto the mark: so that the manifest cause of this, appeareth to bee none other, then the swelling of the water. But here are all other impediments excluded that may otherwise hinder; as mists, foggs, and such like vapours ascending. Also a like reason of the impediments of this aboue written, is, so; that the water ariseth into a swelling, which hindreth the sight of the bottom or sides of the ship (that being in a high place doeth not hinder the sight of the same) as the top of the mast, which either erreth or is equall with the swelling of the water. For men sayling on the mayne sea, see nothing round about but the Sky and the Sea: but conuning nearer the banks, do by litle and litle descry and see, either high hilles or clifffes, as if they were rising forth of the water. Also to those that dwell on a high ground, the sun first ariseth, and last setteth. And to this agreeth, that out of the higher places, both moze and further may be scene into the sea, then in vallies or lower places. By all these therefore it is evident that the vpper face of the water swelleth, as by the example following moze plainly shall appeare: but an other example of the same shall be here rehearsed, by a similitude of one part as the whole. The similitude of which matter conceiue by this example, that experience dayly teacheth vs of the drops of water, which although they be small, yet powred on drie wollen cloth, run into a round or bunching forme; which without doubt shoulde not be caused,

if the part folowed not the nature of the whole of his kind. Now the example aboue promised doeth here appeare, in which by the letter A. is the shippe ment to come vnto the marke C. In which being in the poynte A. that is in the bothom of the shippe, cannot see the marke standing in C. through the swelling of the water. But he which is in the top of the mast, as in the poynt B. without all impediment may see the sayde marke. That the selfe same oꝛ like to it, may be on land, as from the point D. none excepte hee bee foolish oꝛ sturche mad will affirme the like.



A By the second it is manifest that the water by nature is caried and runneth downewarde, and sideth oꝛ falleth from higher vnto lower places, so long, vntill it hath filled and bee even with the earth, through the staying of high heapes of earth, hilles oꝛ such like mighty and high banks inclosing it about that it run no further, noꝛ make no hol- lownes in the middle of the earth, as a Center of the earth. Which therfoze gathereth betwene the empty places, so long, vntill it hath filled and be even with the earth; and that

that the whole together, through the hollownesse thus made equall, doeth fashion and keepe a round forme.

So that the earth, with the sea, and waters running about it, do make one round body, and fill all the whole upper face: the earth also gaping and open somewhere, receiveth water into those hollow places, but a parte of the earth appearing somewhere above it, staying and inclosing it about with strong inclosures and banks (wrought by divine miracle) that the bare places of the earth, might be a commodious dwelling and feeding for all beastes, and other living creatures.

And y this is true, shall be pzooued by other two reasons. The first, by sundry peregrinations, in which many and most large parts of the earth are found toward all the quarters of the worlde, which evidently witnesseth, that the earth is not as Plinie and others writeth; which imagined that the earth is compassed about with water, and appearing so out of the water, like an Aple, or Ball swimming above the water, whose one halfe sheweth out of the water, and the other halfe hid in the water. Which reason Ptolomie doeth not allowe, but simply affirmeth, that the earth with the sea and waters, make one round body, by filling of the empty places, and both to haue one upper face. Also Vitruuius in his ninth booke writeth, that the earth is placed in the middle of the world, and is naturally ioyned together with the sea in the place of the Center. But what the forme of the earth is, above the waters, is yet not thoroughly knowne, by reason of the sea which runneth betwene it in diuers partes, and breaketh it into sundry parts, like to gobbets or peeces.

Ptolomie affirmeth the earth to be knowne, onto the longitude of the halfe Cycle, that is 180. degrees, without any running betwene of the sea in that space; for that the earth is wholly ioyning together. But into latitude, he affirmeth the space to be much lesser, as 79. degrees, and

of this opinion, is both Strabo and Aristotle.

By the second it appeareth, that the water with the earth, doeth equally make one hollow vpper face, and the same to be perfect round; but whether is bigger, is greatly to be doubted: although the learned Nouius, and sundry other late writers, doe affirme the face of the earth to bee bigger then the water.

By the third (which is the Ecclypses) In that of necessity the earth must haue such a forme with the waters running in it, as the shadowe of the earth frameth and counterfeiteth in the Moones Ecclypsis; in that the shadowe sheweth and expresseth the forme of the bodie shadowed. But the shadow of the earth to be included round aboute with a round vpper face, the wise both see & know. Therefore the whole Globe, compounded of the earth and waters, is comprehended with a round vpper face. For it is manifest, that the moone before and after the full, is seene horned, and the part shadowed of the whole cyrcle, is easily to be discerned from that bright circumference. So that the moone entring into shadow, or going out of the same, is likewise in the same manner horned: and the part darkened, is alwaies discerned from the cleare circumference of the whole Cyrcle imbossed. Therefore of necessity must the beginning of the shadow, which separateth the parte lighted, from the shadowed, not be fully straite, nor unequal, nor ballied or winding, but round: and for that cause appeareth the vpper face of the shadowe not to be plaine, but round.

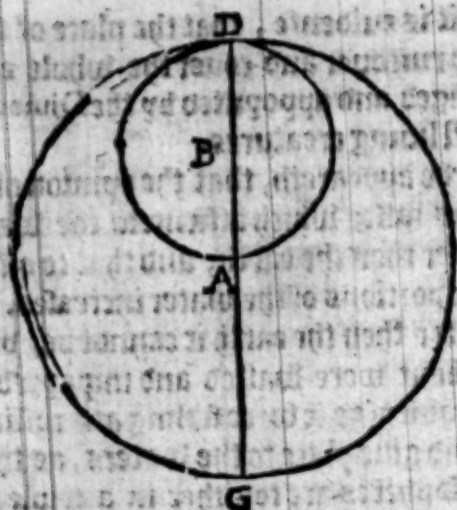
By these is also manifest, as by the first, that there is no difference betwene the Centre of the earth, and Centre of the water: but that the one, is the Centre of both the Elements, ioyning together into one round body, and tending vnto the one and the same Centre of the earth. For the earth (seeing it is the heanier) is opened, and receiueth the waters falling into those places.

By

By the second it is euident, that the place of the water, which ought to run ouer and couer the whole earth, is otherwise chaunged and appoynted by the Diuine will, for the benefit of all liuing creatures.

By the thirde appeareth, that the opinion of certaine Peripateticans is false; which affirmeth the water to bee ten times greater then the earth; and that to one parte of the earth, is ten portions of the water increased. But seauen times greater then the earth it cannot be, vnlesse the earth rounde about were wasted and impayred, by the Centre of the grauity (as it were setting and resting vpon) should yelde, and giue place to the waters, as the heavier. Seeing the Spheres are together in a triple reason of their measures, then if the earth were an eight part, to seuen parts of the water, the diameter of it could not be the greater; as from the Centre of the waters vnto the circumference of them: that is, by double so much vnto the diameter of the water, as by this figure here vnder drawn appeareth: where this letter A. is the Center both of the earth and water, B. the Centre both of the magnitude and earth, G. A. D. the diametre of the waters, A. B. D. the diameter of the earth. If the waters are seuen times bigger then the earth, the diameter of them must needs be double so much vnto the diameter of the earth, as here from G. D. vnto A. D. By which example thus drawne, the whole earth receiveth the Center of the waight, giuing place to the waters, and all couered with waters; to which generall experience gainsayth and denieth, muchlesse therefore can it be greater ten times. By which is to be concluded, that the water is but litle in quantity, in respect of the earth, although it may seeme very bigge, being vp to the edges of the vpper face of the earth. And if the waters had bene moze bigger then the earth, they had drowned or couered the whole earth, euen of late yeares.

That



**That the earth employeth the middle
place of the Worlde, and is the Center
of the whole.**



Riftarchus Samius, which was 161
yeares, before the birth of Christ,
tooke the earth from the middle of
the worlde, and placed it in a pecu-
liar Dybe, included within Mar-
ses and Venus Sphere, and to bee
vzatione aboute by peculiar moti-
ons, about the Sunne, which hee
sayned to stande in the myddle of
the worlde as vnnoueable, after the manner of the fixed
stars. The like argument both that learned Copernicus,
apply vnto his demonstrations. But ouerpassing such rea-
sons, least by the netonelle of the arguments they may of-
fend or trouble young students in the Art: wee therefore
(by true knowledge of the wise) doe attribute the middle
seate of the worlde to the earth, and appoynte it the Center
of

of the whole, by which the risings, & settinges of the stars, the Equinoctials, the times of the increasing and decreasing of the dayes, the shadowes, and Eccclipses are declared.

The earth round about is equally distant from heauen: therefore, according to the definition of the Center, the earth is the Center of the world.

That the stars haue alwaies one bignes, in what place soeuer any shall beholde them: therefore are they in an equall distance from the earth.

The roundnesse of the earthly globe, hath a proportion vnto the roundnesse of heauen; that is, the certaine and proportionall parts in the earthly Globe, doe answere to certaine proportionall partes of heauen: therefore is the earth the Center of the world.

In that fiftene Germane miles on earth, doe answere to a degree of the Meridian: and that in euery houre doe fiftene degrees arise of the Equinoctiall: which coulde not be, if the earth were not in the middle of the world. For the vnequall Arks, should otherwise appeare in the equal times: and the equall partes of the Meridian, shoulde the vnequall spaces on earth answere: which experience daily witnesseth vnto the contrary. And hereof it ensueth, that the earth stands in the middle of the world.

In euery Artificiall day, doe fire signes appeare, and fire like set vnder the earth: therefore is the earth in the middle of the worlde, and is also as a pike, to which the halfe doth regularly moue daily. The like is in the opposition of the Sunne and Moone, when either light is in the Horizont: which coulde not be, if the earth should approach or come nearer vnto one part, then vnto the other.

If it were nearer to eyther of the Poles, then coulde not the vniuersall Equinoctials bee: so that the one Arke alwaies (either in the day and night time) should be greater then the other. The Eccclipses also coulde not bee in the
chan

changes and full moones: For that there shoulde then be vneuen spaces from the South vnto the North, and from the East vnto the West.

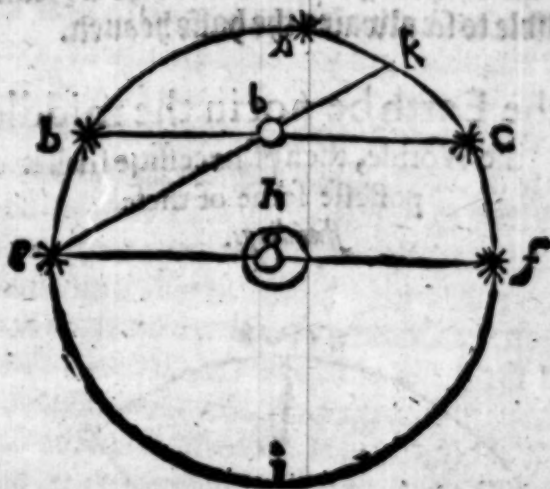
If the earth were not as the Center of the worlde, then of necessity shoulde these ensue, that the earth shoulde approach, either nearer to the East, or West, or South part: and when any of the starres (aswell the fixed as Planets) shall come vnto that part, they shall appeare nearer to vs, then being in any other part of heauen: and by that aboue saide, they shall also appeare greater: which is altogether vnttrue, and we also see the contrary in that (as aboue written) they alwaies appeare of one greatnesse, eyther being in the East, or in the West. Also one halfe of heauen is alwaies aboue the earth, and the other halfe vnder the earth: and this is not onely found and knowne in one quarter of the earth, but the like in euery place (as the Equinotials do witnes) then which there can be no more eident tryal.

A third reason may be alleadged, if any imagined the earth vpon the Center, to be parted into two equal halfes, and that the eye is placed in the Center: then shall the eye see no more then the halfe of heauen. By which appeareth, that the swelling of the earth, from the Center vnto his compasse about, in making a comparison vnto heauen is as in a maner nothing.

And it is knowne to the learned in Altronomic, that any of the fixed starres, is by many times greater then the earth: which if any behold them, they appeare as poynts in heauen. Now how much lesser would the earth appear, if a man should behold it from his place.

Here learne by this demonstration following, that the earth standing without the Center, in the poynt B. being to the Peridiane, as is the poynte A. nearer; and when a star shall come vnto that poynte, then shall it be nearer to the earth, and in the opposite poynt, as is I. shall be from the same much further, than in any other place, and shall
euen

even there lesser appeare, which by experience, is quite contrary. Further graunt that C. D. be the thwart Horizon, yet the contrary, for the second reason, E. B. K. being the Equatour, which from the said Horizon is deuided into two vnequall partes, and by this consequent also must the Zodiacke bee deuided into two vnequall partes, from the said Horizon: for that those two Cyrcles, (as hereafter shall bee taught) doe crosse one another into equal parts.



Therefore when the sun, by his proper motion, carried from the East into the West, shall come vnto the crossings of the Equatour and Zodiacke, and that the greater part of these Cyrcles shall be vnder the earth, it cannot be that the Equinoctium or a like day and night, can bee thorough out the earth, no not vnder the right Sphere, much lesse can it be vnder the thwart Sphere.

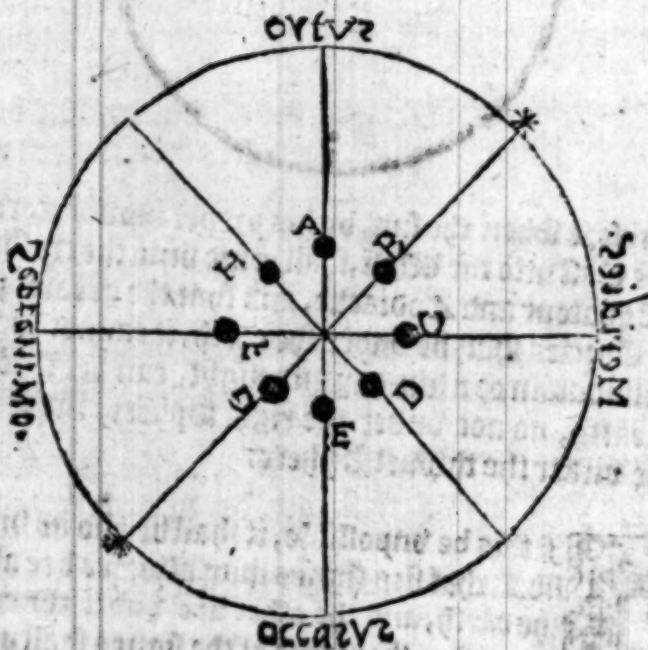


If this be vnpossible, it shall be also as vnpossible, that sixe signes may allwaies bee aboue the earth, and the other sixe vnder the earth; but rather that moze of the signes shall be vnder the earth, and moze of them aboue: euen

as

as the earth is imagined to be deuided from the Horizon
aforesaid, into two equall parts; like as when it shall bee
in the Center of the whole, and that from each Center of
the greater Cycles, the earth is deuided into two partes.
As all these (to any beholding the materiall Sphere) are
sozthwith knowne at the first sight: so by a third reason is
to bee noted, that when any imagineth, by the lyne E. F.
that the earth in the poynt G. standing as in the Center of
the whole, is deuided by the middle, as well beeing in G.
as H. soz the exceeding distance from the Cycumference,
is vnpossible to see alwaies the halfe heauen.

If the Earth be not in the middle of
the Worlde, then of necessitie shall it
possesse some of these
standings.





First, the earth is placed without the Cre-tre of the world, yet in such sort, that it is equally distant from either Pole: that is, that the Equinotiall may be in the plaine vpper face, as in the letter D. appeareth.

Secondly, that it is standing on the Cre-tre of the world, yet without the playne vpper face of the Equinotiall; that is, that it be nearer to eyther of the Poles, as in the poynt B. or G.

Thirdly, that it is neyther standing in the Cre-tre of the world, nor in the plaine of the Equinotiall, as in the poynts, A. C. F. E.

The first standing being granted, these absurdities shoulde then ensue, thzough the diuers placing, in diuers and sundry places of the playne Equatoure.

1 In the right Sphere, shoulde neuer the Equinotium (or a like day and night) be caused, in that the Horizont shoulde neuer cut or part the Equinotiall into two equall halves.

2 In the thwart Sphere, shoulde no Equinotiall bee, and somewhere againe shoulde the Equinotiall be, but not in the middle Parallell, betwene the two Tropickes; that is, it shoulde not happen the sun being in the Equinotiall, but in an other lesser Parallell Cycle, being nearer to eyther Tropicke poynt.

3 The time from the rising, vnto the Pone tide, shuld not be equall to the time from the Pone tyde vnto the setting of the sun.

4 The magnitudes and spaces betwene the fixed stars, both in the East and West, shoulde not be scene equall or a like.

In the second standing, if that the earth shoulde bee placed

ced on the Ere-tree, and not in the myddle of the wo:ld, then should these absurdities ensue.

In euery Climate, the playne of the Horizon should cut heauen into two vnequall halfes, except those places hauing the right Sphere: yea, and the Zodiacke should be deuided into two vnequall Arks, so that there should be somewhere more, and somewhere lesse then six signes of the Zodiacke scene aboue the Horizon, which is contrary to all experience.



2 The Equinotiall shadowes, both of the rising and setting of the sun, shold not agree, in such sort that they might fall in right line. Neither the shadowe of the rising of the sun in the Solstitial or longest day, should make or stretch in right lyne, with the shadowe of the suns setting, in the Summall or shortest day, *et econuerso*

In the third standing, if neyther it should be on the Ere-tree of the wo:ld standing, nor in the plaine of the Equator; then should the same absurdities ensue, which are vnterred in the two former.

To conclude, wheresoener the earth is generally placed without the myddle of the wo:ld, there is the reason of the dayes equal increasing & decreasing in the thwart Sphere confounded, and there shall eyther no Equinotials at all be

bee caused, when the sunne occupieth the myddle way betwene either Tropicke. For the Moone alwaies shadow the suns light, although he cometh right against the bodie of the sun. And the earth not standing in the myddle of the world, shall not shed or stretch his shadow to the moon. So that all these absurdities and vaine argumentes doe grant, that the earth cannot bee in any other place, then standing in the middle of the world.

That the Earth abideth fixed and

ymoueable, in the myddle of
the world.



That neyther the earth, in right nor Cyclare motion is drawn about the Cre tre of the world, nor about any other Cre tre, but to rest and stay in the myddle of the world; both holy scriptures confirme, and Philicke reasons proue. For the Psalmes sayth, which stablished the earth vpon his foundation, that it shall neuer bee moved. And Ecclesiastes in the first chapter sayth: that the earth standeth for ever, and the sun both riseth, setteth, and goeth about vnto the place where he arose. Also that the sun is drawne about, the Psalmes doth manifestly witnesse, where it is saide: that for the sun, he hath placed a Tabernacle in them, and he, as a Bridegrome going forth of his chamber, doth reioyce as a Gyant to runne his course, which goeth forth from the uttermost bound of heauen, and returneth about vnto the ende of it againe. Also it is knowne and numbred among myracles; that God would haue the sun to continue.

The Phisicke reasons are these.



That of one simple body, is onely one simple motion. That the earth is a simple bodie: therefore therebnto agreeth but one simple motion.

But of the simple motions, I haue before taught, that the one is in right maner, and the other in Cyclicall forme. That the right motion seeketh downwards vnto the myddle, whether being caried, they settle and rest. Therefore is the motion of the earth not cyclicall about.

By the second appeareth, that euerie graue or heauie matter by nature, is throught his waight caried after a most strait lye vnto the Center, and both settleth, stayeth, and resteth at the same; where it neither falleth, or is caried any further. So that all graue matters, as the parts of the earth, and those which consist of the earth, are sent or caried by a most straight leading vnto the earth, and at his upper face shall stay and rest. And weare it not that they are staied throught the fastnesse of the earth, they should so long be caried downwarde, vntill they came vnto the Center. Also the earth throught his fastnesse, receyueth and beareth all thinges falling on it. Therefore doeth the earth much more (being within the Center) stay and rest fixed and vnmoueable, bearing all other heauie thinges falling on it, seeing the earth is heauiest of all others.

By the third it is euident, that if the earth shoulde be moued or caried, it shoulde of necessity be either drawne in right, or cyclicall motion. If it shoulde be caried in a right maner (seeing it is the heauiest of all others) it shoulde by his swiftnes moue and goe before all other heauie thinges, and shoulde leaue behinde the liuing creatures, and other thinges fastned to it, and shoulde also leaue them hanging
be

behinde in the Ayre.

If the earth should be drawne about by a cyrculare motion, & should in a daies turme (at the least) be caried about the Cre-tre, from the West into the East, as either alone or with the first Dybe: then euery day, should many most disordred things, and contrary to experience happen. For it should be a most speedy motion, and swiftnesse inseparable, which should draw cyrcularly all the whole earthly body rounde about in 24. houres. And therefore that the earth is caried with so swift motion, should not onely ouerthrowe buildinges, but high hilles, and greatly shake and harme all thinges fastned and growing on the earth: yea all liuing beasts, and other creatures dwelling on the face of the earth, should be likewise shaken and harmed. Also the cloudes, foules, and whatsoeuer liueth and hangeth in the Ayre, should be caried and leste behinde at the setting in the West. For by the swift turning about of the earth should all things be ouer turned, and left behind by a greate and long space; if by such a swiftnesse, the earth should be turned about the Cre-tre of the world. Or if by the motion of the earth, the ayre, and all things hanging in the ayre, should be drawne with a like swiftnesse; then should they appeare to stay, or not to be moued at all. And further, if a stone or any waighty thing cast vpwart should not light againe downe right on the same place: as may be seene in a shippe, at sayling. So that to all these, doeth euident experience deny, that by no motion, the earth is any thing moued, but continually stayeth and abideth.

By the fourth it is manifest, that in the motion and turning about of the Cyrcle, the Center abideth vnmoueable: which is the earth, placed in the myddle of the world, and is as the Center of the worlde. Therefore is the Earth knowne to be vnmoueable.

¶

That

That the Earth compared vnto Heauen,
is as a poynt.



Although to the vnskillfull in this Arte, the magnitude and largenes of the earth seemeth to be of an exceeding greatnesse, that no bound or ende can be decerned with the eie; no; any hauing trauailed into farre countries, could bytherto finde any bounds of the same: yet the greatnesse of the earth compared vnto the mighty largenesse of heauen is accompted but a pizicke; as the Geomitricall rules declare.

The earth also is a very small thing, in respect of heauen: yea so litle in comparison, as a pepper corne, or saxe of Colliander, vnto a Cycle of a thousande paces compass.

For if the earth compared to the firmament, were of any sensible greatnesse, a man shoulde not see the halfe of heauen, no; the halfe Cycle of the Equinotiall or Zodiacke. And howe much greater the earth shoulde be, by so much the lesser should a man see the halfe of heauen. But the contrary is knowne, in that on any plaine of the earth or vpper face of the sea, a man alwaies seeth the halfe Sphere of heauen, the other halfe (in the meane time) remaining hid: and of this the halfe dyameter of the earth is so small, vnto the distance of the firmament, that it may take away nothing in a manner of the halfe Sphere, extant to the eye.

Besides these, if the earth should be imagined to be placed in any of the Orbes of heauen, it would be appeare but small in respect of them: for being imagined in the Moones Orb; the earth should appeare thrice as great as the moon is decerned from thence, and somewhat bigger. And from the suns Orbe, the earth should be decerned twice so large
as

as Venus doth here appeare to vs. And if in Marcs Sphere you would say that the earth is equall to a small star: But from the firmament, Saturns Sphere, or Iupiters (if a man could decerne it) the earth shoulde appeare so small, that a man would be abashed at the sight of it.

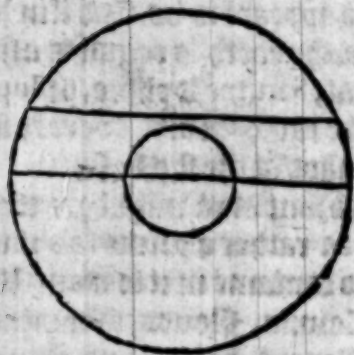
And here an ignozant man, might greatly wonder, that so small a body, yea rather a pizicke (as it is accounted of the learned) should containe in it so many Realmes, Provinces, Citties, Towns, Flouds, Mountaines, Woods, Valleyes, Seas, Riuers, Lakes, and many other greate matters, ouer long to be written.

That the earth also is as a Pizicke, is declared by sundry reasons following.

By the first, that round about the earth, the magnitudes and distances of the stars, in their times, are decerned and scene euery where equall and alike.

By the second, that the Gnomons or dyall shadowes, and the Centers of the Sphericall borderes or Cycles, placed in any part of the earth, do somuch auaille, and keep the considerations and gyardings about of shadowes, so regularly, and agreeing to the rule and matter, as if those (in very dede) shoulde bee placed in the myddle poynte of the earth.

By the third, that the Horizont doeth euery where deuide the whole heauen into two equall halues. For that in euery moment, doe fixe signes of the Zodiacke appeare aboue the Horizont, and in the night time being a fayre sky are they to bee scene with the eye, and so many (at that instant) hid within the Horizont: so that by a continuall drawing about of heauen doe fixe signes appeare, and as many right against those fixe, set vnder the earth. If the magnitude of the earth shoulde bee of any light portion vnto heauen, then so much of the Center (the vpper face drawne aboute) shoulde parte or deuide heauen into equall halfe Spheres.



The other Spheres reaching from any part of the upper face, shoulde deuide the same into vnequall portions. Neither halfe the Zodiacke shoulde alwaies appeare, but a portion, much lesser then halfe the Zodiack shoulde be seen aboue the earth, so that the greater parte of the earth, though the solydnesse excluded and hidden, shoulde not after be sene.

By the fourth, the Equinoctiall shadowes, both of the rising and setting of the sun, doe make a right line, euen as if they shoulde be streached out and lie on the plaine, caried by the Center of the earth. So that all these shoulde not be caused, if the magnitude of the earth in respect of heauen, shoulde be of a sensible, or of any portion to it. To conclude, Ptholomie vseth alwaies the body of the earth for the Center of the worlde, not deuiding the vpper face from that which is not in sight of the earth.

Certaine affirme, that one degree of the greatest Cycle in heauen contayneth 57051. common Germane miles. Of which one degree of any earthly Cycle in the vpper face of the earth, doeth amount to 15. Germane miles. And that one minute of the celestiall degree, expelleth, 9502. Germane miles, which (if this bee true) and certainly knowne, then is it not vainely thought and gessed, that the earth is as a Pycke, in respect of heauen.

To finde the compasse of the Earth, and
by it the Dyiameter.



The whole compasse of the earth, according to Ambrosius, Theodosius, Macrobius, and Eratostenes, doth containe 5400. Germane myles, and the dyiameter of the same, doth containe 1718 $\frac{1}{2}$. Germane miles.

But the authority of Eratostenes (after the minde of Plinie) is more to bee regarded, then the other three Philosophers, which proueth by demonstration and reasons, that the compasse of the whole earth is, 252000. furlongs.

Yet Hipparchus finding faulte at Eratostenes, doeth as firme the compasse of the earth, to be of 277000. furlongs. And a furlong is here (after the agrément of the Geometricians) of a hundredeth, twenty, and six paces.

And this sentence is not here mente, that there is any ambiguity or vncertainty in this reason: but that the one affirmed lesser, and the other more furlongs. For after Eratostenes, doe 700. furlongs answere to one degree: but after Hipparchus, 774. furlongs answere to a degree. So that there is no other diuersity in the matter, but onely the number.

Ptholomie that was after Eratostenes, attributed seven hundred fifty furlongs of the earthly merydiane, to one degree of the celestiall meridiene. So that by all these appeareth, that the magnitude of the earth is as yet vnsounde out, through the difficultie of measuring. And this whole compasse is not onely ment of the earth, but of the earth and water ioyntly together, both which are saide to make one Sphere.

Also Eratosthenes gathereth the compasse of all the earth by Dye, by the proportion of the pericular, or the degree of the celestiaall Cycle, vnto the like space on earth. For he affirmeth, that to one degree of the celestiaall Equatour, answere 700. furlongs, or 15. Germane myles, but Ptolomie attributeth to a degree, 500. furlongs.

Which is thus to be vnderstande, that a Cycle be imagined on earth, directly vnder the Equinoctiall or Perydian lyne, deuiding the earth into twoe halles: and that this Cycle be likewise deuided into 360. parts or degrees as the celestiaall Cycles are.

And ech of these parts both like vnto the celestiaall parts, containe 700. furlongs, or 15. Germane myles. This now being tryed and found, what the whole Summe eyther of the furlongs, or myles of the whole circumference of the earth, which containeth 360. parts or degrees: you shall easily finde and knowe the same by this maner. Multiply the whole compasse of the earth, that is, the 368. degrees, by the 700. furlongs, or fiftene Germane myles, and the whole compasse shal either appeare to be 252000. furlongs, or 5400. Germane myles.

This whole compasse of the earth, deuide by 22. and the number comming thereof, shall bee the 22. part of the compasse of it; that is, 11454 $\frac{1}{2}$. furlongs, or 254 $\frac{1}{2}$. Germane myles.

And abate this 22. part, from the whole Summe of the circumference, and the number in furlongs shall remaine and be 240545 $\frac{1}{2}$. and in Germane miles 5154 $\frac{1}{2}$.

And if any of these sums be deuided a part by 3. it shal be found in furlongs to be 80181. a halfe, and a third part, or 7 $\frac{1}{3}$. And in Germane myles 1718 $\frac{1}{2}$. that is, the diameter of the earth, aswell in the furlongs, as Germane miles.

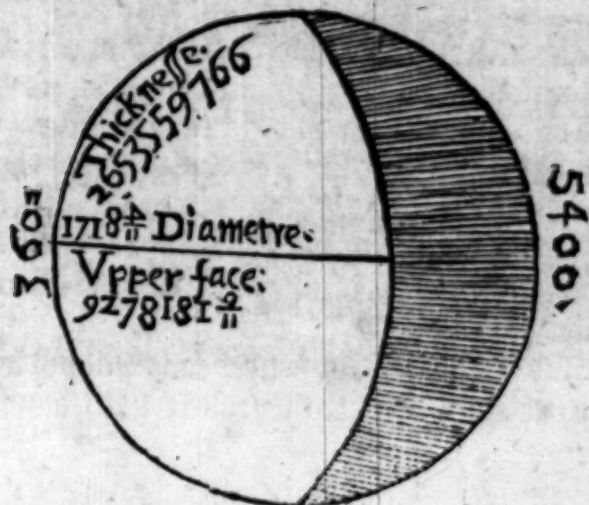
And Archimedes by sundry labours, and witty inuentions, and by Geometrical practise, hath found, that the like

proportion is of the Circumference of the whole Circle vnto the diameter of the same, as is 22. vnto 7. that is, the diameter thrice, with a seauenth part and a halfe.

But whensoever any man will (by the circumference of the Circle) gather and finde his diameter, worke the numbers thus, as this example teacheth. First, set down 22. at the left hand, toward the right hand 7. and the circumference between those two numbers, 22. 5400. 7. After multiply the first by the second, that is, 7. by 5400. the number increased, which is, 47800. deuide by the thirde, that is, 22. and you shall finde in the quotient, 1718 $\frac{4}{11}$. Germane myles.

Do thus in furlongs, the number being set downe alike 22. 252000. 7. then multiplie the first by the second, as 7. by 25200. and the increase shall be 1764000. after the increased number: deuide by the third, as by 22. and the diameter shall be, 80181 $\frac{1}{11}$.

If any couet to finde the vpper face of the earth, by the diameter, and circumference known, worke one into the other, and you shal haue that you seeke. But if you desire to knowe the thickeesse of the earth, then ioine the superficiall souldenes of the Sphere, vnto the first part of the diameter, and you shall obtaine your desire.





THE SECOND PART OF THE SPHERICALL

Elements of the Celestiall Cir-
cles, with the vses of the
same Circles.

*What is the Summe of this
Second Part.*



Whereas in the first part, were only
the rudiments of the Sphere han-
deled and taught (which are also
written and contained in diuers
Whyle books) as of the World,
and the many parts thereof: that
is, of the Celestiall and Elementa-
rie Region: And also of the parts,
motion and forme, of the Celestiall
Region: as Heauen, and the forme, standing, and quan-
tity of the Earth.

Here in this second parte shall fully be set forth, and
largely handled, the manifold vses of the Circle, of which
the

the materiall Sphere is framed and made. Further this second part is deuised into thre partes, the first teacheth the deuision of the Cycles (in that the auncient Astronomers, for a playner instruction, deuised heauen into sundry Cycles) and of these some in greater, and other some in lesser Cycles. In the second part, are the definitions, descriptions, and vtilities of all the Cycles taught. In the third and last part, are the places of the Zones, learnedly described, and the vtilities of them.

So that this second part doeth especially intreate of the Cycles (seeing the principall poynte of the Sphere, is of the celestiaall appeerances) which by reason of the celestiaall Cycles, or of the first moouer are caused; as may appeare of the ascensions and descensions of the signes, by which the whole knowledge aswell of the naturall as artificiall day is learned.

Wherefore in that this instruction of the ascensions of the signes, consisteth in the Cycles (which the auncient Astronomers imagined to be in the first moouer) therefore is this second part of the celestiaall Cycles, aptely placed, and necessarily before taught.

That the Sphere of the worlde, is either
right, or thwart.

The roundnesse of the earth, as is afore taught, both altereth the standing of the Poles, and the whole Sphere of the worlde, in diuers partes of the earth. For to them which dwell vnder the Equatour, either Pole falleth to the playnesse of the Horizot. But to others dwelling without the Equatoure, the
one

one Pole is rayfed, and the other depressed & hid : through which diuerfitie of the standinges of them, are these differences caused ; that the risings and settings of the signes are altered; the spaces betwene the dayes and nights varied, whose causes ought diligently to be sought. Therefore is the right Sphere, distinguished from the thwart Sphere of the worlde. In this maner, as here you may be holde by these figures following.



That is called the right Sphere, in which either Pole resteth and standeth on the plaine of the Horizon and the Equatoure : which there doeth exactly possess the middle place betwene the Poles, and doeth with the Horizon make a right sphericall angle : of which it is so named a right Sphere. For they haue such a standing vpon the Sphere of the worlde, as that neyther of the Poles is eleuated aboue the Horizon, to them which dwell vnder the Equatoure.

And to cut at right Angles, is none other, than so to cut a Circle into a Circle, that the Angles which are caused on eyther side, are alike equall, as this parte of the Equinoctiall, A. B. C. and this part of the horizon D. A. E. which is crossed of the Equatoure in the poynt A. and the Angle B. A. D. is equall to



the Angle B. A. E. therefore shall B. A. crosse into D. A. E. sphericall wise perpendicularly, and the Angles D. A. B. and E. D. B. shall bee both right, by the definition of the right angle, as was before taught.

The thwart, declined, or bending Sphere, is that, in which either of the Poles of the world eleuated, is sene above the Horizon, and the other iust somuch set and hidde beneath the Horizon: and also that the Equatoure frameth and maketh with the Horizon thwart and vnequall angles. And that is called a bluntee angle, which setteth the Pole eleuated: and that a sharpe angle, declining vnto the contrary.

They which dwell on this side, and beyonde the Equatoure haue such a Sphere. But the same forme and condition of the thwart Sphere, is not euery where; nor the posture of it, the same reason: but that the thwartnesse of the Sphere is so much the moze increased, as by how many degrees either of the Poles are nere to the earth: and beeing further distant from the Equatoure, is rayled and caried higher, which is the cause of many obscure differences: which that they may the plainer be expessed and vnderstanded, the skillfull practioners haue denided Cycles in the first mouer, by lynes drawn vnto certaine stars or pickes from the Center of the earth, and drawn about either by a continuall or dayly motion, by which they imagined them to be described.

That the Circles of the Sphere, be
some greater, some lesser, and the number
of the Circles.

Here it is not to be omitted, that one Cycle is greater then another, by foure meanes. First, by reason of the magnitude of the celestially body in which it is
imagi-

Imagined to be. And of this is the Equinotiall Cycle of the first mouer, greater then the Equinotial Cycle of the eight spher, in that the first mouer is greatest of all the bodies. And although the Equinotiall of the eight Sphere, doth deuide it into two equall halves, yet of the first mouer it is named the greater, for that the same includeth all other bodies.

By the second, it is euident that the Equinotiall Cycle is greater, by reason of the appearance, in that the whole is seene about the Horizon. And by the same reason the southerly Cycle (which is named the Arcticke Cycle) is the greater, for that it alwaies appeareth to vs, about the Horizon.

By the thirde, the Equinotiall is accounted greater then the other, in regarde of the influence vertue: and for this cause also is the Zodiacke called greater then the others, through his greater working into these inferiour bodies. For that vnder it, the sun and all other Planets are drawne. And Hipparchus writeth, that this Cycle is the life of all thinges which are in the world, &c. In that by the ascending of the sun to vs, generation is caused, and by his falling or going from vs, diminishing, that is corruption getteth the vpper hand.

By the fourth, is a Cycle called greater then the other, insomuch as it is one Sphere, and thus the equinotiall, is greatest of all the Parallell Cycles, in the first mouer: which is evidently demonstrated, by the diameter of the Cycle. Therefore by the definitions and reasons aboue shewed, the equinotial is the greater Cycle, described in the vpper face of the first mouer, according to each part, or the whole of it, being equally distant from either Pole of the world.

And it is further to bee considered, that all the Cycles of the Materiall Sphere, are imagined to bee in the first mouer, which also a materiall Sphere doeth especially represent

present. So that these Cycles, may also bee imagined in the other Spheres, aswell as in the eight Sphere, &c.

And although a man may enter into conference betwene these Cycles and the diameter, yet he shall be forced to confesse that they be on such wise vnto the sphere, as the Cycle is vnto the diameter. So that as the diameter deuidenth the Cycle into two equall partes (in that it passeth by the Center of the same) euen so doeth euery of the greatest Cycles deuide the Sphere into two equal parts, because the playne vpper face of it passeth by the Center. And by this it may easily bee perceyued, that those which are named the lesser Cycles (of which is a farre greater number than is here set down) haue diuers Centers from the Center of the Sphere; and yet the playne vpper face of them passeth not by the Center of the same Sphere. Of which ensueth, that they cannot deuide the sphere into two equall halves: no more then the lyne drawne without the Center, into a Cycle; can deuide the same into two equal halves. And both the greater and lesser of these is ment, according to the distance of his Center, from the Center of the sphere.

The inward Cycles that be mouable, are those, which are describ'd in the first moouer, and are drawne with it about: as is the equinotiall, the Zodiacke, the Colures, the Tropickes, the Polare Cycles, and others describ'd from the poyntes of the first moouer. But the outwarde Cycles, are they that are as immoueable, and not drawen about with the first mouer, but abide steady. The number of which are these: the Peridiane, the Horizont, the houre Cycles, the verticall Cycles, and Cycles of the p'ogressions.

Further it is to bee noted, that many are the Celestiall Cycles (as is aboue declared) whose vse partely vnto Astronomy, and partly vnto Astrologie, is necessary. As the verticall Cycles, the Cycles of the altitudes, the Cycles

des of the celestiaall houses. The Cycles with the which the materiaall sphere is describ'd: and to bee briefe, there are so many celestiaall Cycles, as there may bee poyns ymagined in the first mouer.

Yet are there but onely ten Cycles, which are required vnto this sphericall treatise; whose names are the Equinoctiaall, the Zodiacke, the two Colures, the Meridian, the Horizont, the two Tropicks, and the two Polare Cycles.

The greater Cycles are those, which haue the same or a like Center with the earth, whose playn vpper face doth passe by the Center of the earth, so that they deuide the sphere, into two equall parts (and especially the equinoctiaall) which for that it is a greater Cycle, doth cut the sphere into two equall halues; so that his playne vpper face passeth by the Center of the earth, according to the definition of the greater Cycles. And by this consequent, when the Sun is in the equinoctiaall, he falleth into the Center of the earth; that is, he is in the vpper face which passeth by the Center of the earth. And the sun is neuer in such an vpper face, but when he is in y two equinoctial poyns for other wise, he runneth without that vpper face. For the greater Cycles are a like vnto the Sphere, as the diameters vnto the Cycle: in that as the diameter cutteth the Cycle in two equall halues (for that it doeth passe by the Center of the same) euen so doth the greater Cycle deuide the Sphere into twoe equall halues, in that the playne vpper face of the same, doth passe by the Center of the sphere.

But the lesser Cycles are those, which haue diuerse Centers, from the Center of the sphere, so that the playne vpper face of them doeth not passe by the Center of the sphere. For how much nearer the Center of the same is to the Center of the sphere, and somuch the greater is that Cycle, as the Tropicke. But the further it is from the Center, euen so much the lesser in sight is the Cycle, as

are the Polare circle.

And here none may suppose, that either these or other like cycles, to be verily in the first mouer, but only to be vnderstood or imagined. For the cause of deuiding heauen into certaine spaces and regions, through the helpe of which, the courses of the Planets are obserued, & brought vnto a rule.

Further the office of the celestiaall cycles; are these.

1 That they deuide heauen, into certaine spaces, or regions.

2 The courses of the Planetes, the firmament, and first mouer, by the helpe of these cycles are obserued, and brought vnto a rule.

3 They shew the points of rising and setting, the nearnesse and differences both of dayes and nights.

4 The times and varieties of all the celestiaall appearances, may bee obserued and knowne of the cycles by a certaine reason.

The sixe greater cycles are numbred by names, standing, and vse distinguished.

As the	{	Equinoctiaall.
		Zodiacke.
		Colure of the Equinoctiaalls.
		Colure of the Solstices.
		Meridiane.
		Horizont.

But there are many others, as the Cycles defined or describ'd by the Poles of the Zodiacke, and Centers of the Stars, which are named the cycles of the latitudes.

The



The Cycles drawne by the verticall poynts of diuers places, which may bee named the cycles of the distance, or space betwene places. For that the toppes doe knit or ioyne together by the highest space of the differences of places, and doe shew the distance of them.

The cycles by the Centers of the stars, and Poles of the worlde drawne, are named the cycles of the declinations of the stars.

The sixe cycles of the positions (through which by the thirty parts of the Equatoure, and the poynts, touched of the Horizont and meridian drawne ouer the Equatoure) doth Regiomontane part and deuide the whole heauen into twelue equall spaces, which hee nameth the houses of heauen.

The sixe greater cycles (through which by the Poles of the Zodiacke, and the thirty partes of the same bended

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and wythed) doeth Iulius Firmicus deuide the Zodiacke into twelue equall parts, but the Equatoure into as many vnequall arks.

But that foꝛmer distribution and disposing of the Cyꝛcles by Regiontane, both deuised and demonstrated of him, doth bꝛing and cause a reason of the framing of the figures of heauen, which they name Rationall: in that the same inuented and taught by pꝛinciples and demonstrations, is declared by certayne reasons. The other inuented and exercised of others, doth bꝛing and cause another reason of the foꝛming and erecting of the figures of heauen, which of the same they name the equall maner; in that it parteth oꝛ deuideth the Zodiacke into equall arks. Many other cyꝛcles there are, which foꝛ breuity be here ouerpast: so: that they belong not vnto this determined treatise of the pꝛinciples.

The lesser cyꝛcles, although there are in a maner infinite of them, yet are there foure only recited and especially knowne, which also are named Parallells.

As the { Tropicke of Cancer.
 Tropicke of Capricorne.
 The Articke or Northerly Circle.
 The Antarticke.

Of the foure greater cyꝛcles, afoꝛe wꝛitten, they both are moueable, and are continually dꝛawne about with the first mouer and neuer changed. But the two neather cyꝛcles, as the Peridiane and horizont, doe remaine and abide fixed and immoueable, in the going about of heauen, and the standing allwaies changed on the earth, towarde what quarter soener they are varied, as they may be and are in a maner infinite in number.

The Astronomers deuide, both the greater and lesser cyꝛcles, into 360. degrees, which they so named thꝛough the

the suns passage or iourney in the Zodiacke, measuring and defining by his dayly course such like partes and spaces. And of these partes or degrees of the greater cyrcles, it is found and known, that each degree containeth in the vpper face of the earth, either 62500. paces, or 500. furlongs, or 15. Germane miles. But each parte of the lesser cyrcles, doe comprehend a lesser space by somuch, as by howe much more from the magnitude of the Parallell, which is the middle and greatest, by reason of the distance they lacke or differ.

And each of the thre hundredeth thre score degrees, are also parted or devided into thre score minutes: and each minute, into thre score seconds: and each second into thre score thirds: and so forth from thirds vnto fourthes: and so vnto tenths, they distribute them.

The description, names, and vtilities, of the Equinoctiall.



The Equinoctial, which the Grekes name *iquos*, is a greater cyrcle, placed in the myddle place of the Sphere, betwene either Pole of the worlde, and deniding both by equall spaces moueable, and crosing the Zodiacke in two poyntes, which when the sun doth come vnto, her they causeth a like day and

night throughout the earth: whereof this cyrcle first purchased that name; in that the day is equall to the night, which happeneth twice in the yeare, as in the beginning and entraunce of the sun, both into Aries and Libra.

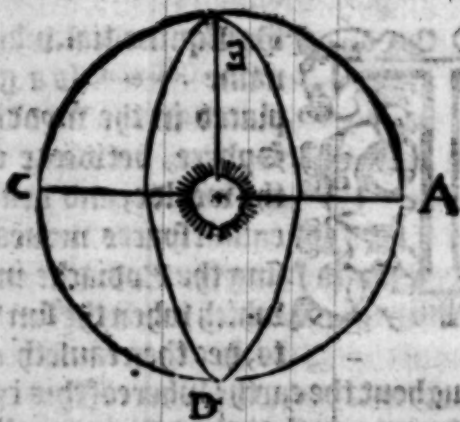
And a straight lyne drawne out by imagination doeth describe this cyrcle, reaching out of the Center of the earth by the Center of the suns body on a plaine or flat, of the C.

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quinotiall being vnto the first moouer, or vnto any of the fired stars to the Equatoure, fastned to the eight Sphere, as that either of them, which with the thirde being somewhat lower and darker doe fashion the gyrdle of Orione, and that by a dayly and continuall turning or atone about of the first moouer, vntill the same bee returned vnto the place, from whence it began.

And likewise the sun, or any other constellation placed or being in it, doth in every region describe the halfe of the Parallell aboue the Horizont, and the other halfe, vnder the Horizont: which Ptholomie nameth the cyrcle of the Equatoure of the day: and Alphraganus, the cyrcle of the Equinotiall, and smathe or gyrdle of the first moouer, in that it compasseth about the first moouer (as Strabo writeth) that it parteth the northerly halfe Sphere, from the southerly. For this greater cyrcle of the first moouer, is the first measurer, both of time, and motion.



In that it causeth the proportionall circumferences by the spaces of times: and whiles it is once or atone about, a naturall day is performed. And whiles the compasse also of the whole, haue moued one foure and twentieth part, an equall or Equinotiall houre hath passed: by which it
doth:

doth evidently appeare, that this cyrcle, belongeth vnto the first mouer.

This Worthy Circle hath diuers names.



1 It is named the Equinotiall, in that it causeth a like night, to the artificiall day.

2 It is by the same reason named the Equatoure; for that it maketh equall the night, to the day.

3 It is named the gyrcle of the first mouer (not vnproperly) for that as a gyrcle doeth gyrcle or deuide our body into two equall halues; euen so this cyrcle deuideth the sphere or first mouer, by the middle.

4 It is named the line of the equality of the day, or the line of the equation of the Daye of the day, or the iust deuision of the day and night.

5 Of Plinie it is named the Center of the earth, and that not incongruently; seeing all the Parallell cyrcles described from the Center of the sun by the motion of the first mouer, haue their Centers from the Center of the earth: and that the Equatour onely, which when the sun shall be in the Equinotiall poynt, is then imagined to be drawne aboute with the motion of the first moouer, that hath the same Center with the earth at that time, by which the playne of the Equatoure, is then noted to passe. So that this is the cause why Plinie giueth that name to it: seeing a like day and night is caused, the sun then running vnder the Equatoure throughout the earth, as no man of skill maketh doubt of.

It is named the cyrcle of the high solstice; but this cometh to passe, by reason of those which dwell vnder the e-

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quinotiall, and haue foure solstices; as two on hie, & two below, hauing foure shadowes in the yeare: and the sun passing twise a yeare by the Zenith, right ouer their heads (as when the sunne is in the beginning of Aries and Libra.) And to them also dwelling vnder the Equinoctial are two summers and two winters: and the heat is mightiest and strongest, when the sun draweth from them into the North, or South; yet doeth the sun alwaies burne the earth right vnder it, causing a burning Zone, and not parteth far from their heades. So that their winters are not perfectly and simply named winters, as with vs which are cold seasons in dede; but rather with them is a continuall summer: yet so, that the causes of heate with them, are not vniformally, and in a like maner alwaies, so, that the sun doth not appoach equally the Zenith of that parte, as the same is known to many: whereof the heat to them is not vniforme and a like in burning. But sometimes hotter, and sometimes slacker and meaner of heate. So that when the sun is in the Zenith, as in the beginnings of Aries and Libra, and that they are in their high solstices; then is the heate most vehement with them, yet not without the sun, this heate can bee called mighty. But when as the sun is gone from their Zenith, which happeneth in the beginning of Cancer and Capricorne, where their low solstices are, the heate is then slacker: that is, lesser burning. So that the weaker heate hapning in the low solstices, may in a manner bee named colde, in respecte of the most burning heate, hapning in the high solstices, yet it hath the nomination of winter, although no cold may bee felt.

What

What the offices or vtilities of the
Equinoctiall are.



He causes whie the skilfull practi-
sioners toke and vled the Equi-
noctiall, with the offices which
they attributed to it, and the mani-
fold vles that it offereth, is herein
declared.

1 It measureth the motion of
the first and vppermost Dybe, and
sheweth the same to be drawne a-
bout by a continuall and equall swiftnesse. For that in e-
very equall houre, doe fiftene of the thre hundredeth and
thre score degrees of the same arise, and so many degrees
right against, set and are hidden vnder the Horizont: and
that all the thre hundredeth and thre score degrees, in 24.
houres, are turned about in the appoynted times, and in
their periods continually agreeing. And as the Equatour
from the Poles of the worlde (about which the first mouer
is drawne, and is of either side distant by equall spaces)
nor the Angle, which is comprehended & fashioneth with
the Horizont doth neuer change: euen so (by the same or-
der and like motion) doeth the first heauen or moouer eui-
dently shew it selfe to be caried about. For the Equinocti-
all measureth and determineth the motion of the first mo-
uer, in declaring his revolution and yeare: which yeare of
the first moouer, is the time of 24. houres equall. But by
what meanes the auncient astronomers first found, that
the Equinoctiall is drawne about in so many houres: and
it is supposed they came to the knowledge thereof, by the
office of some starre, either in the Equinoctiall, or placed
neare it, they perceiued the same: as that the Equinoctiall
from some note marked of them, did returne to it in such a

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certaine space, as afoze shewed.

2 The diuers motions of the Zodiack (which hapneth to it through the thwart standing or lying) as a cannon or rule, doth direct and point out the beginnings, boundes, and time, with the which each parts or degrees of the Zodiacke arise, or doe set: and with which they touch these or those quarters of the worlde. For all the arches of the Equatoure, are drawne by a certaine and agreeable motion continually. The parts of the Zodiacke drawne thwartly, the Equatoure doeth not varie or is distant by like spaces from the Poles of the worlde, nor turned about his, but the same Poles of the worlde, which doe differ by a long space from his, and drawn about by a most unlike motion and nothing at all agreeing in it selfe: For that some parts or degrees are caried vp sooner or quicker, and others appeare slower and later. So that these vseth a more space of time in the rising slower, and those other passe by by a shorter and quicker space. But seeing that in the Zodiack the wandring stars or Planets, doe wander continually hither and thither, and from one side of it to another: and that vnto the middle cycle of it or eclipticke line, the places of all the fixed stars are referred and applied: therefore cannot the times of the rising or setting of the starres, be knowne and noted, except they shoulde be guessed and attained, by the next arcs of the equinotiall. It also declareth the equinotialles, which are caused in those proper dayes, in which the sun hapneth to come into the equinotiall cycle. For these are caused the sun being in the first degrees of Aries and Libra, in that the Zodiacke and Equinotiall doe crosse each other in those places; whereof Manilius thus writeth.

That these signes *Aries* and *Libra* cause a right,
Throughout the earth, a like day and night.

3 It defineth and measureth the spaces, both of the naturall and artificiall dayes. And although the sun (which drawne

drawne about with the motion of the first moouer, and in the proper motion, caried forth in the meane time by force into the contrary, when as hee causeth the times of the daies and nightes, so wel as the differences of the natural daies) mooued, and runneth in the Zodiacke; yet of his motion, the day and night spaces cannot bee gatherd, through the diuersity and vnlikenesse of the ascending or arising of diuers parts or degrees of the Zodiacke. But seeing the same motion is of all the partes of the Equatoure; therefore are the ascensions of the arks of the Zodiacke, caried vp with the ascending of the highest parts of the Equatour, like arising. So that both the dayes and houres, by the equall motion of these, are not founde and distinguished by the vnlike and vnequall motion of them, in that these ascensions can be, of these two cycles.

The Grækes by no meanes like of the same, in that by a steadfast order, they do mark the day and night times; therefore they parte and deuide them into equall houres, which they named times, that from the degrees of the Zodiacke they might distinguish them. For euerie fiftene parts or degrees of the Equatour in his motion and rising about the Horizon, doe make an houre, and euery degree foure minutes of an equall houre: so that the quarters or fiftene minutes of each degree, doe produce and cause one minute of an houre. Also they obserued the ascensions and descensions of the signes in this cycle, so that in any region or countrie, a man may knowe the length of the artificiall day and night, by hauing a sphericall instrument, and the sun placed in the East Horizon, let the note of the Equinoctiall be moued, and after the sun being turned into the West Horizon, let the note againe of the Equinoctiall be moued into the East Horizon. So that the degrees of the Equinoctiall numbred, marked with these notes, do cause an artificiall day, counting alwaies fiftene degrees of the Equinoctiall, for an equall houre. To conclude the length

length of the artificial day, known by subtracting the same from 24. houres, the quantity of the night remayning shall appeare howe much it is. Last the sun being entred into this cyrle, doth rise in the iust East point, and setteth full West: but in the highest of summer being come to Cancer, he riseth North-east, and setteth North-west: at what time the none-tide is highest. But in the shortest time of winter when the sun is come to Capricorne, hee contrariwise riseth Southeast, and is in the none-tide lowest.

4 It distinguisheth the Equinotials and crosseth the Zodiacke thwartly wretched and bended to it, in two opposite points, which when the sun commeth and is in it, he causeth like spaces of the day and night: and of the same, those entraunces of the sunne, are named the Equinotiall points.

And there are two Equinotials caused in euery yeare: as the one, the sun entring the beginning of Aries, or the spring poynt of the crossing of the Zodiacke and Equinotiall, in the beginning of the spring, which the Latines name the equinotiall spring, and the Greekes, *Isimerian earinén*. And the celestiall point of the same equinotiall, the Greekes name the point of our equinotiall spring. The other equinotiall is caused, when the sun hath his beginning of Libra, in the entrance of haruest, called the equinotiall haruest. And the celestiall point in which the sun happeneth, they name the pointe of our Equinotiall haruest.

These points remaine not fixed in one place of heauen, but in the going befoze doe procede or moue forwarde vnder the eight Dybe, and turne befoze the places of the fixed stars. For the point of the equinotiall spring, that in the first yeare of Olimpias folowed the first star of Aries of the eight Sphere, 4. degrees, and 52. minutes. And in the yeare of the death of Alexander, one degree, and 58. minutes.

The same after the beginning of the yeres of Iulius, Cesar,

star, followed 4. degrees, and 50. minutes. And in the yeare of Christs byrth, 5. degrees and 16. minutes. In Ptholomies time, 6. degrees, and 40. minutes, it went before the same star: and in these yeares it went before that star, 27. degrees, and 35. minutes.

So that the yearely times of the Equinotials are come backe, from the auncient time, and moue before the marked dayes by a long space: For that the Equinotial spring which about the beginning of the yeares of Olimpias, hapned in the first or second of Aprill. In the beginning of the yeares of Cesar, in the 25. day of March. In the time of Christ our Sauours byrth, in the 23. or 24. day of March. In Ptholomies time, in the 22. or 23. day of March. But in our time it hapneth, in the 11. or 12. day of March, and in this yeare 1570. it happeneth in the 11. day of March, and in the 11. howre before none, on Saturday.

The Autumnall or harvest Equinotiall, which hapned in Christ our Sauours time, in the 23. or 24. day of September, is brought backe and come in this our time, vnto the 13. or 14. day of September, and in this yeare 1570. shall happen in the 13. day, and in the 10. howre, and 21. minutes after none, on Wednesday.

And through this variation of the fixed stars, and Equinotials, is caused, that the later practitioners haue found an other quantity of the yeare, contrary to the auncients. For Hipparchus and Ptholomie, haue stablished in their time the quantity of the Tropicke yeare, to bee of 365. dayes, 5. houres, 55. minutes, and 12. seconds. The Alphonsines, of 365. dayes, 5. houres, 55. minutes, and 12. seconds, Albategnius, 365. daies, 5. houres, 46. minutes and 56. seconds. Cardanus, of 365. daies, 5. houres, 48. minutes, 41. seconds, and 47. thirds. And Thebitius hath stablished the starrie yeare to be of 365. dayes 6. houres, 9. minutes, and 32. seconds, which is the space of time, in which the sun returneth vnto the same fixed star. But the Trop

Tropicke yeare, is the suns returne, after his measuring of the whole Zodiacke, vnto the Equinoctiell or solsticiall point. So that by the saide pointes changed, either in the increasing or coming sooner, as hitherto hath bene obserued, is the quantity of the yeare, found to be in diuerse and sundry wise of the practisioners.

By it also is learned and knowne which stars and images celestial, are toward the North or South from it. And by it is the starrie skie deuided into two equall halfes, of which the one halfe is toward the North, and the other toward the South. So that the denomination, so well of the Planets, as fixed stars, are there by learned; whether they bee Southerly, or the Northerly. An other authour writeth thus of it; that it deuiddeth heauen into two parts, of which the one is named Northerly, of the seauen stars in the great Beare; the other Southerly, in that the sun about the South, seemeth alwaies to abide with vs in that quarter. And if the same may be knowne, which stars are named Northerly, and which Southerly: and when the Planets are named Northerly, and when Southerly. So that by this reason, all the stars and images from it, tending toward the North, to be Northerly: and from it tending toward the South, to be Southerly.

The Northerly images, in respect of the Equinoctiall, are these.

The Bull named in latine Taurus, is adorned with 33. stars, although an other writer mentioneth but of 32. Of these, 5. are in the face, and about the eyes, and in the places where the hornes are described to be, are one star a piece, which make seauen in number; named Hyades in Greeke, and Succullæ in Latine, in that they stand like to the letter Y. These in the 10. 11. and 12. degrees of Taurus, hauing their latitude Southerly: of which 4. are of the third bignesse, and one brighter then the rest in the Southerly

therly eie, named properly Aldebaran, of the first bignes, and of the nature of Mars. The seauen stars on the back of this signe, named Pleiades, and in Latine Virgilia; but in English the clustring stars; in that they stande so neare together that they can scarcely be numbyed: yet these more regarded then any of the others, in that at the appearance of them, Summer is signified; and at the setting of them, (which is five moneths after) winter is then in entrance, like which is not shewed in the other signes. And in our time, they are in the 22. and 23. degree of Taurus, the sun ioyneth with them every yeare, in the thirde and fourth day of May. So that after those daies, through the suns departing from them, they are knowne to arise heliace before the sun, and then is summer entred: which in our time hapneth about the 7. 8. 9. or 10. day of may. And when the sun is come (by his course) vnto the 22. and 23. degree of Scorpio, which hapneth in our time, in the 5. and 6. day of Nouember, then is the sunne directly against Pleiades: and the sun then arising in the morning, they doe set: and aboute these daies, (as in the 5. 6. 7. 8. 9. and 10. day of Nouember) winter is entred. These as Ptholomie writeth, are of the nature of Mars and the Moone: but all the others, being some of the third and fourth, and some of the first bignesse, are of the nature of Saturne, and a litle of Mercurie.

The signe Gemini is placed in heauen, as that betwixen them and Taurus, is that constellation Orion standing their headed deuised from the rest of the body, yet embracing one the other by bodies, and doe directly set with the feete, and arise together bended, as they were lying. Of which those two be the notablest, that stand in the heads: and that clear star in the head which goeth before (named Castor, and of some Appollo) hauing besides in eyther shoulder a cleare starre, in the right elbowe one, in either

knex

knée one, and in either foote one star. And the other which followeth, beeing next to Cancer, hath in the heade a star named Pollux, of others Hercules, on the left shoulder one, in the right another, and in the other partes sundry other stars, to the number of 18. knowne in both. There is an other star standing without the forme of Gemini, going before the foote of Gemini, and following after, called Propus: and is in our time, in the 24. degré of Gemini. Of which two are of the second bignesse, as those in the heads, but the others are of the thirde, fourth, and fift bignesse. And are all of the nature of Saturne, saving the head going before is of the nature of Mercurie: and that in the heade following, of the nature of Mars.

The signe Leo looking vnto the West, is placed on the body of Hydra, and not in the head, by which Cancer is nigh vnto the halfe of it, hauing the middle deuided by the summer cyrcle, in such sort, that vnder that Orbe he hath the fore feet placed, setting and rising with the head. Also he hath in the head three stars, in the nape of the neck two, in the breast one, in the space betwene the shoulders vnder the necke or behinde the necke three, in the middle of the taile one, in the ende of the taile another, and in the belly one cleare or bright star (named the hart of the Lion) which also is called aroyal star, in that it is more about the Zodiack then the other great fixed stars; and for this cause called a star of the first bignesse, although in truth, it is but a star of the second bignesse, being of the nature of Iupiter and Mars. All the stars which this signe hath (as Ptolomie writeth) are 27. Of which many are of a greater brightnesse, as the two in the nape of the necke, of the second bignesse: that on the heart, of the first bignesse, another on the backe, of the second bignesse: another in the end of the taile, of the first bignesse: and all the rest, of the third, fourth, and fift bignesse.

The

The image named the Carter, hath 14 stars, being all noted in Gemini, and of the 1, 2, 3, 4, 5, and 6 bignesse: of the nature of Mars and Mercurie. Also this image named the Carter, hath a cleare starre, named the Coate standing on his left shoulder, being a starre of the first bignesse, and in our time in the 15. degree of Gemini: becomming nature of Mars and Mercurie. And that image of constellation named the Ribbes, (beeing two small stars, standing on the left hand of the Carter) are in our time, in the 12. degree of Gemini, of the fourth bignesse, and of the nature of Mars, and Mercurie.

The image named Perseus, hath 16. stars which forme two perticular images: of which that which is seen on his left side, is named Corgon, or the head Algoll. And hereof it cometh that they are called the Corgon stars. The other scene on his right side, the ancient astronomer's name the Cycle as ithe. Also Ptolomie in the description of Perseus, attributeth to the heade of Algoll (that is Medusa) as to a perticular image, foure starres. And the brightest stars of them (being in the heade of Algoll is the 12. star) is in our time, in the 12. degree, and twenty minutes of Taurus. The following star (being of the fourth bignesse) is in our time in the 18. degree of Taurus. And Ptolomie writeth, that the head of Algoll beeing of the second bignesse, is of the nature of Saturne and Iupiter: and that on the right side of Perseus, of the second bignesse, is of the nature of Saturne and Iupiter, and is in our time in 24. and 28. minutes of Taurus.

Op the head of Aries (not far from the feete of Andromeda) standeth a figure, which the Greeks call the likenesse of the letter Delta) name Deloton, and the Latines,

times, for the similitude of the fourme called a Triangle. This figure hath three equal sides, but the third not so perfect fashioned, yet easily to be knowne; for that it shineth brighter then many other starres about it. To which the starres of Aries are a little Southerly. And to it Ptholomie attributeth foure stars, although all other authors affirme onely three stars, except Alphonsus, which in our time are in Taurus, being of the third and fourth bignesse, and altogether of the nature of Mercurie.

The image of Andromeda (placed in heauen with the armes stretched abroad, and each hand bound) Ptholomie declareth it to haue 22. stars, of the third, fourth, and fift bignesse, and in our time are in Aries and Taurus, whose nature resembleth Venus.

This Cassiopeia is figured like to a woman sitting in a chayre, with the handes lifted vp after a wayling manner, and in the turning of the world about, she is vpright with the head alwaies vprward. Ptholomie dooth number 13. stars in that image, of the 3. 4. 5. and six bignesse, which in our time, are in the signes Aries and Taurus, and of the nature of Saturne and Venus.

Among the Astrologians onely Ptholomie and Alphonsus doe place twoe horses in heauen: (as I may more rightly speake) the two partes of horses: of which the one is called the fore horse, or head of the horse, to which Ptholomie attributeth foure darke stars, which in our time are in Aquarius.

The other figure named of the Arabians, Alpheratz, in English the second horse, the halfe horse winged, or Pegasus, whose fore parte is described vnto the nauell: and of this, doth the greater number of authors write. Ptholomie decketh this image with 20. stars, being of the 2. 3. 4. and 5. bignesse, which in our time are in Aquaries, Pisces, and Aries, altogether hauing the qualitie or nature of Iupiter.

pieter and Mars.

The celestiaall image of this fish named the Dolphin, the ancient men placed in heauen among the starres (not far from that constellation named the Eagle). And many of the ancient astronomers, attributed but 5 starres to this Dolphin, which are of the thirde, fourth, and sixte magnitude, and in our time be in Aquarius, retaining the nature of Saturne and Mars.

The figure named the celestiaall Arrow, placed in heauen without a bowe, to which the Swaine dyeth, is neare to the South. To this Arrow doth Ptholomie attribute sixe starres, which in our time are about the end of Capricornus, being of the fourth, fift, and sixt greatnesse, and hauing the qualitie of Mars, and a little of Venus.

The figure named the Eagle (whereon Aquarius seemeth to fly) which many affirme to be Ganymedes, Ptholomie doth deck with nine starres, of the fift, thirde, fourth, and fiftie bignesse, that in his time were in Sagittarius and Capricornus, and in our time are in Capricornus, which follow the qualities of Mars and Iupiter.

Many auncient authours vnder the celestiaall Harpe, the Gripe falling, which so that there is so little thereof mentioned, shall here bee ouerpasse. But Ptholomie giueth to this celestiaall Harpe, 10. starres, being all of the first thirde, and fourth magnitude, and in his time were in Sagittarius (except the fift and sixte starre) which then were in Capricornus, and haue the qualities of Venus and Mercurie.

The image Hercules (named of Aratus and sundry others Eugonasis) is thus placed in heauen, it maketh the Dragon appeare to haue his heade vp right, and Hercules with the right foote, the knee beeing bended or bowed, seemeth with the left foote to thrust downe the right side of his

head, and in his right hand holding by a greate haile as it were to stricke, and couered on the lefte side with a Lions skin, seemeth earnestly to fight and slea the same vnarmed. This image doeth Ptholomic describe with 29. stars, and others onely 28: which in our time are all in Libra, Scorpio, and Sagittarius, and of the quality of Mercurie.

Where Aratos, Ptholomic and Alphonsus write of the manner of Crownes (as the Northerly, and Southerly) therefore shall first bee shewed of the Northerly Crowne, and after of the Southerly in their proper place. This bright constellation named the Northerly Crowne, doeth Ptholomic declare to haue 8. stars, which in his time were all in Virgo, and at this day are in Scorpio. And in the same constellation is a bright star, of the second bignesse, by the name of the whole image: of the Arabians named Alpha of Virgill, Geor. Guofia.

The image named the Swan, the Peacock, the Hen, and the Criepe lying, doeth Ptholomic decke with 17. stars, of the seconde, thirde, fourth, and fift bignesse, and in his time were in Capricornus, Aquarius, but in our time are in Capricornus, Aquarius, and Pisces, and bee all of the nature of Venus and Mercurie.

The image named Arctipholar, or Bootes, which in English may bee named the Bearded man, or rather the keeper of the wagon, in that he seemeth to follow the wagon: that is the Northerly stars. And Plinie writing of Boots, (which he otherwise nameth Arcturus) doth affirme, that this constellation in a manner neuer riseth, but a stormy haile enueth. Also Arcturus is a bright star not in fashion of the first bignesse, standing betwene the legs of Bootes, as Ptholomic writeth: but Hyginus, Rufus, and others, doe place that star in the girdle of Bootes. This Bootes, (after Ptholomic) hath 22. stars, which in his time were in Virgo and Libra, and in our time are onely foure of the first in Virgo and all the others in Libra. But as touching the

the natures of them, Ptholomie doth onely write of Arcturus, which hee affirmeth to haue the nature of Iupiter and Mars.

The image named Cepheus, Ptholomie affirmeth to haue twelue stars, of the third, fourth, and fift magnitude beeing in his time in Pilces and Aries: and in our time in Pilces, Aries, and Taurus, and following the nature of Iupiter and Saturne.

The image named the celestiaall Dragon, that other ancient men name the Serpent, hath (after Ptholomie) 13. starres placed ouer all: which in his time were in Libra, Scorpio, Sagitarius, Capricornus, Aquarius, Pilces, Aries, Taurus, Gemini, Cancer, Leo, and Virgo, and in our time are in these; Scorpio Sagitarius, Capricornus, Aquarius, Pilces, Aries, Taurus, Geminini, Cancer, Leo, Virgo, and Libra: being of the 3. 4. 5. and 6. bignesse. Those that shine brightest are eight, and of the thirde greatnesse, as that third star, which is on the eye; the fift star which is on the heade called Rastaben; the 24. and 25. declining vnto the North, the 29. which standeth beyonde the furthest winding, the 30. which is nere the end of the taile, and the 31. which is at the very end. And these brighter shining stars are of the nature of Saturne and Mars.

The image named the greater celestiaall Beare, and of many (for the fourme of the starres standing together) Charles-Waine. All the seauen stars, of which two be alike, and are scene in one place, called of the auncient the two Oxen, in that they seeme equally to moue, as yoked Oxen. The other 5. starres they imagined to fashion the wagon and the signe or image next to it, to be Bootes, or in English the wagon driuer, which seauen stars (being the greater Beare) are drawne once about the Pole of the worlde in 24. houres, and neuer set out of sight: for one while it carrieth three vnto the highest, and the other foure vnto to the lowest: and an other while it draweth the

four vnto the highest, and bringeth the thre to the lowest. This constellation named the greater Beare, doeth Ptholomie declare to haue 27. stars, which in his time were in Gemini, Cancer, and Leo, and in our time in Cancer, Leo, and Virgo, hauing all the qualitie of Mars. But here I ouerpasse all the stars of that constellation, and onely take those which form the wagō (being 7. in number) of which foure in the order of the stars of the greater Beare, becing the 16. 17. 18. and 19. that goe before the wagon, or the wheeles of the same. The 16. 17. and 19. are of the second greatnesse, but the 18, is of the third bignesse. The 25. is of the second signe (named Alioth) that is before the beame which containeth the poake. The 26. and 27. that stand in steade of the places of the two Dren. All these are described, in a maner after the minde of Hyginus, but Cesar the Germaine attributeth the thre stars of the taile, to the beame of the wagon, and the other Starres to the wheeles of the wagon.

The figure named Cynosura, the litle Beare, or lesser wagon, did the men of Syria moze diligently regarde, supposing to saile the truer and surer by it: and of this thought thzough their first finding of the same (to haue it called after them, Phenicen. This litle Beare after Ptholomie, called the Southerly stars, or lesser wagon (as aboue said) hath seauen stars, which in Ptholomies time were in Gemini and Cancer, and in our time are in Cancer and Leo. Of these the first star, which is on the ende of the tayle, is named the Pole star, about which the first moouer is supposed to be drawne, and is of the third bignesse. The two following stars in the taile, and the two fore wheele stars, are of the fourth bignesse, and the two hinder wheele stars following, are of the second greatnesse, and these starres haue the quality of Saturne, and a litle of Venus, as Ptholomie in primo Quadri, writeth.

The Southerly images, in respect of the Equinodtall,
are

are these.

The signe Libra is a part of Scorpio, which through the magnitude of the members is deuided into two signes, of which the figure of the one they called Libra. And that part was rightly named Libra, in that when the sun is entered the beginning of that signe, the day and night is deuided a like as by an equall ballance. For the Equinotiall haruest like hapneth, at the entrance of the sun into Aries as the Equinotiall spring doeth. This signe hath eight stars (which are in forme) of which one in the Southerly ballance and another in the Northerly ballance, and of the second greatnesse. But the others which either do follow or mooue before either ballance, are of the fourth and fift bignesse. Nine others there are which bee not in forme, placed within and without the ballances. Being all of the nature of Mars and Mercurie.

The fore part of Scorpius is so hidden of the Equinotiall cyrcle, that it appeareth to stay or hold the same vp. It setteth with the heade inclined, and ariseth right vp. The signe Scorpio hath in those (which are called the knees) in each of them two stars, of which the fore stars are the clearest, and haue the quallity of Mars, and a parte of Saturne. It hath also in the foreheade three stars, of which the middle stars is the clearest, and of the thirde bignesse. In the space betwene the shoulders vnder the necke, three stars. In the belly two. In the toppe of the taile five, with the which he is supposed to strike, two stars. In the whole the signe hath 24. stars. That one star which is named Antares (or the heart of the Scorpion) is of the second greatnes and of the nature of Iupiter and Mars. And many stars (especially those which are placed on the body) are of the 3. greatnesse, and haue the quality of Iupiter and Mars. The stars by the forehead, of the nature of Mars, and parte of Saturne. The stars on the legges and feet, are of the fourth and fift bignesse, and haue the qualitie of Iupiter, Saturne.

¶ iij.

Mars,

Mars, Mercurie, and part of Venus.

The signe Sagitarius looketh vnto the West, and is figured with the body of a Centaure, as it were shooting arowes, beginning from the fete, vnto the shoulders. It is so placed in the winter cyzcle, that his heade onely may seeme to appeare without the same Cyzcle: whose halfe Bow is deuided by the milky cyzcle. And before his fete standeth the Crowne decked with certaine stars: he seteth headlong, and ariseth straight vp. This signe hath in the head two stars, of the fourth bignes, of the nature of Mars and the Sun. In the right elbow one, and in the forehead one. In the belly one, in the left shoulder one, of the third bignes, and quality of Iupiter and Saturne. The stars of either side the roote of the tayle, of the fift bignes, and of the nature of Venus, and parte Saturne. In the fore knee, one star &c. This signe in the whole, hath 31. stars. Of which those on the Bowe, on the North, South, and middle part, are of the third bignes, and of the nature of Iupiter and Mars. And two on the left fote, of the second bignes, the one on the right ankle, of the third bignes: and that star in the right elbow, of the fourth bignes, and hauing the quality of Iupiter and Saturne al the others are of the fourth or fift magnitude.

The signe Capricornus looketh vnto the West, and is wholly figured in the Zodiacke cyzcle. The taile with the whole body, is deuided by halfe (of the Winter cyzcle) and reacheth to the left hand of Aquarius, he setteth headlong, and ariseth right vp: hee hath a star on the nose, and another going before the two stars in the mouth, another following them, and another Southerly of the thre in the mouth: all of the firt bignes, and of the nature of Saturn, and part Mars, and Venus. A star going before the thre, vnder the right eye of the fift bignes, and of the nature of

Mars

Mars and Mercurie. The Southerly of the thre following behinde the hozne, of the third bignesse; the Northerly of the thre behind the hozne, of the third bignesse. The Northerlier, and Southerlier of the stars in the necke, of the fift and sixt bignesse. In the neck betwene the shoulders seauen, on the breast two, on the belly and body seauen of the fift bignesse, and of the nature of Mars and Mercurie. The stars on the taile, of the third, fourth, and fift bignes, and of the nature of Saturne and Iupiter. In the whole hee hath 28. stars knowne, of which the two on the hoznes are of the third bignesse, but all the others be of the fourth, fift, and sixt bignesse.

The auncient astronomers as Aratus, Hyginus, and others, do assigne thre images in one constellation: as the Hydra or monstrous serpent, on whose taile they describe the Rauen to sit, & almost in the middle of the same figure, they affirme the cuppe to stand. It is a signe in the South part, hauing the heade declining vnto Cancer: the halfe of whose winding body is placed vnder Leo, but he reacheth the taile vnto the Centaure, on which the Rauen doeth sit. To this Hydra or water serpent, doeth Ptholomie giue 25. stars, being of the second, third, fourth, fift, & sixt bignesse, his beginning in Ptholomies time was in the fourtene degree of Cancer, but the end almost in the fourtene degree of Libra: and in our time the beginning is in the 4. degree of Leo, and the end in the third degree of Scorpius, beeing of the nature of Saturne and Venus.

The great water Cup or pitcher, doth Ptholomie decke with seauen stars, being of the fourth bignes, which in his time were in Leo and Virgo, and in our time in Virgo, and of the quality of Venus, and a litle of Mercurie.

The Rauen (after Ptholomie) hath seauen stars, being of the third, fourth, and fift bignesse, which in Ptholomies time were all in Virgo, & in our time are in Libra, hauing the quality of Saturne and Mars.

The celestiall figure named the Aulter, doeth Aratus

place in heaven, vnder that beast called the Wolfe, neare to the South, and standing vnder the taile of Scorpius. To this figure doth Ptholomie assigne seauen stars, that in his time were in Scorpio, of the fourth and fift magnitude: but in our time are in Sagitarius, and haue the quality of Venus, and a litle of Mercurie.

The image named the Centaur, is thus described of Aratus, that the parts of this image likned to the man, do ly within the signe Scorpius; but the hinder halfe likened to the Horse, lyeth or standeth vnder the Knees. And is likened to one hauing his right hande continually open, towarde the round aulter. And as one offering sacrifice on the aulter, which sacrifice the monster holding in his right hande to offer on the aulter, they call a wilde beast. In that monster or Centaur named of Hyginus, Chiron, doth Ptholomie number 37. starres, of the first, second, third, fourth, and fift magnitude, which in his time were all in Libra, but in our time in Libra and Scorpio. The starres standing fashioned in the forme of a man, haue the quality of Venus and Mars, and those which represent the forme of a horse, are of the nature of Iupiter and Venus.

The image named the celestiall Wolfe, doeth the Centaur seeme to hold: yet it is a seuerall constellation from the other. To which Ptholomie doth assigne 19. stars, being of the thirde, fourth, and fift magnitude, that in his time were in Libra and Scorpio, and in our time are all in Scorpio.

The celestial figure named the Riuer streached from Orion, doe some name Eridanus, which otherwise Padus, some Gyon or Nylus, and some Oceanus. To this Riuer Eridanus, that commeth from the left foote of Orion, doeth Ptholomie giue 34. starres, of the first, thirde, fourth, and fiste bignesse: that in his time were in Aries and Taurus, and in our time in Aries, Taurus, and Gemini. The last star of the 34. in the rowe (of the first magnitude) hath the qua-

quality of Iupiter, and all the others, are of the nature of Saturne.

The long Ship (named Argo) not the whole forme of it is described or scene among the stars (in that it is deuided from the fore part vnto the mast) that may signifie to men little to displaye, although the Shippe happen to breake. Aratus writeth, that the fore halfe of Argo, is turned about right with the taile of the great Dogge. But in a contrary order mooued, in that the fore halfe is scene, and the other halfe hid; much like a ship rising with the swelling of the Sea, whose fore halfe is scene, and the other halfe hid, through that hinder parte darkned or hidde, and without stars. To the ship Argo doth Ptholomic ascribe 45. stars of the 1. 2. 3. 4. and 5. magnitudes. The greater of these in order 44. of the first bignesse, is that star (named of the Arabians Rubail, of the Latines Canopus) which standeth at the end of the Rother sterer of the shippe, that in Ptholomies time was in the 17. degree, and 10. minutes of Gemini, hauing the Southerly latitude 75. degrees, and the declination Southerly 51. degrees, and 41. minutes. And in our time is almost in the 7. degree of Cancer, hauing his latitude Southerly 75. degrees, and declination of 51. degrees, and 34. minutes. All the other stars are of the quality of Saturne and Iupiter, and were by Ptholomies time, vnto our time in Gemini, Cancer, Leo, and Virgo.

The celestiall Hare placed vnder the feete of Orion, is as hee were running befoze the houndes of Orion, being fained to be a hunter. To this celestiall figure doth Ptholomic assigne 12. stars, of the thirde, fourth, and fift magnitude, that in his time were in Taurus and Gemini, and in our time are all in Gemini, and haue the quality of Saturne and Mercurie.

The image named Ingula, and also Orion, lieth thwart vnder to the section of Taurus, and hath starres standing and shining befoze the feete of Taurus; named Orion of the
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woorde Vrina: that is, of the floude of waters. For in the winter time (when this image or constellation ariseth) he troubleth both the Sea and Land, with showers of raine, and tempests. The Romanes also name him Ingula, for that he appeareth armed, as girded with a sword, whose shape is terrible and most cleare to be seen in the shining of the stars. For if it shineth bright and cleare, then doth it portend fayre weather to follow, if it appeare dimme, then doth it threaten a tempest to ensue. The head of this signe is drawn by three stars, of which the two cleare stars, are called the Shoulders, betwene which stars the necke is imagined to be, and thereof named Ingular. Plinie doth often make mention of Orion, as of his rising and setting whole, and in some places of part, as his gyrdle, or sword. Also he doth number Orion among the fearefull stars, causing tempests. To this Orion doth Ptholomie assigne 31. stars, which whiles hee liued, were all in Taurus and Gemini, of the 1. 2. 3. 4. 5. and 6. magnitude, and one cloudy. The second star is of the first bignesse, and the thirde is, of the second bignesse, in the order of the stars of Orion, which are in the shoulders, and haue the quality of Mars, and Mercurie. The constellation named the Zone or gyrdle of Orion, hath three stars shining very bright, of the second greatnesse, in the order of the stars of Orion, beeing the 26. 27. and 28. That figure named his sword hath 6. stars of the third and fourth bignesse, decked in the order 29. 30. 31. 32. 33. and 34. The figure named the Clubbe that Orion bare in his right hand, when he fought with the dreadfull Bull, that posselleth foure stars, of the fiftie and sixt bignesse. In the order 9. 10. 11. and 12. of these the 9. and 10. are in the right hand. Further the other stars, either of the first or second bignesse, as the 26. 27. and 28. be of the nature of Iupiter and Saturne. But the other stars which are in the 3. 4. 5. and 6. and the cloudy star, do imitate the quality of Saturne, the 35. which is

on his left foote, is of the Arabians named Rigel, of the first bignesse, and referred to the nature of Iupiter; but the others vnto the quality of Iupiter and Saturne.

The auncient astronomers placed two Dogges in heauen, as they were following the Hare running: of which the one they named Procion, and the other the Dog. The image named Proceon (in English the fore-Dogge) hath no other name with the Romanes, the the Caniculer; that is, the lesser Dog. And of Tully (in *fragmentis Astrati*) hee is named the fore-Dog. But the other doeth Aratus place vnder the hinder foote of the fore-Dog. To this fore-Dog doth Ptholomie attribute onely two stars, others do number three, that in Ptholomies time were in Gemini, and in our time are in Cancer. Of which the fore star which is in the addition of the same, doth possesse the magnitude. The second star, which standeth on the legge shining bright, is Procion; of the first bignesse, al are of the nature of Mercurie, and a little of Mars.

The other Dogge being the greater, is named of the Arabians Alhabor, which properly is named the greater dog. And this vnderstand, that the same starre is brightest shining, which standeth on the mouth or tung of the Dogge, being of the first bignesse, and named by authoers the dog, in the name of the whole image. The star named Syrius or the Dog, is placed in the middle Center of heauen. vnto which when the sun shall come, the heate is then doubled, and mens bodies affected with faintnesse. Also they suppose that star to be called Syrius, though the brightnesse of his fiery shining. The Latins name him, the Caniculer or Dog star. Of which the Caniculer or Dog daies were named: in that whiles the sun runneth in that part, it is dangerous, and this through the quality of the season then being, that disposeth the time to health or sicknesses. And herof it is, that whiles for a time it ariseth, the season is not alwaies contagious. Ptholomie nameth that Starre which

which is on the mouth of the Dog; and assigneth him to be of the first bignesse, most cleare and bright in shining. And to that star which standeth or is placed on the head, he giueth a small quantity: that is, to be a star of the fift bignes. Auicen thus writing of the Dog daies, willeth men to be ware, and learne the time in which the greater Dog ariseth, and the season in which the snow lieth still on the high hilles or mountaines, and the frosty or sharpe colde time, for then is no apt time of ministring medicine. But a medicine may safely bee druncke, or otherwise giuen, in the spring and haruest time. Hippocrates beeing of the same minde, affirmeth that in the Dog daies, and before them no purgation may safely be ministred. The beginning of the Dog daies varieth, according to the diuersity of Regions, Climates, and Latitudes. In our time the Doggedayes begin at the suns entrance into the 10. 11. and 12. degree of Leo. That which aboue was said, that the star Syrius is in the middle Center of heauen, is ment that the star is in a celestiaall cyrcle, as the Solsticiall colure, whose Center is the Center of heauen, in which that cyrcle is described. This vnderstand, that the sunne is then ioyned with the star Syrius, when they both arise together in the Horizon above the earth, and setteth Helicace West with the sun, though it cannot be sene rise in the morning, for the bright beames of the sun: but after the suns dayly moving from it, the star beginneth to arise and be sene in the morning before the sun. To a man of knowledge this is not strange, that the Dog star ariseth once euery naturall day: yet the words of Auicen are thus ment, that in what time the Dog star ascendeth with the sun, and this at the Horizontall meeting and ioyning together of them in the morning: which pestilent Canicular time do the physicians determine to be of 40. daies long. But the malice of that season is many times overcome & changed through the strong beames of the Planets hapning in this time: as
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of Iupiter, Venus, and sometimes of Saturne. Ptholomie both assigne to this constellation named the Dog star, 18. stars, of the first, 3. 4. and 5. magnitude, that in his time were all in Gemini, and in our time in Cancer (except the 17. star) which is in the end of Gemini. And that which is brightest shining in the Dogs mouth, is named Alhabor, having the quality of Iupiter, and a litle of Mars, and al the others applied to Venus.

Hyginus writing of this image, named the Southerly Crowne (which of many is named Vraniscus) as if the same appeared fashioned hollow from heauen. The same doth he thus describe, that befoze the fore feete of Sagitarius, are a fewe stars, fashioned into a roundnesse, which forme his Crowne, that many haue imagined as cast from him in bondage maner. And many meane by this Greke word *Ouraniscos*, the Palat, in that this crowne appeareth fashioned like to the Palate, which is a hollownesse aboue the tounge. To this celestiaall Crowne, fashioned like a litle Palate, both Ptholomie assigne 13. starres, of the fourth, fift, and sixt magnitude, that in his time were all in Sagitarius, and in our time are in Sagitarius and Capricornus, of the nature of Saturne and Mars.

This image do some name the monstrous fish, the terrible fish, the monstrous sea beast, and sea Lion or Beare. This huge fish named the celestiaall Whale, is placed vnder Aries, and both the fishes, lying a litle aboue the starry Riner in the Region of heauen. Ptholomie both assigne to this celestiaall Whale 22. stars, of the third, fourth, and fift bignesse, that in his time were all placed in Pisces and Aries, and at this day are in Pisces, Aries, and Taurus, and most of them are of the nature of Saturne and Venus, and some onely of Saturne.

This Meridiane fish (named the Southern or Southerly fish) and greate, whose Aliances are the fishes named, which are placed in the cyzcle of the Zodiacke. This signe

or image is placed in the South parte, and seemeth (as it were) with the mouth to drinke of the water coming from the signe Aquarius. Ptholomie doth number and giue to this Southerly fish, 11. stars, being of the first, fourth, and fift magnitude, that in his time were all in Capricornus and Aquarius, and in our time are all in Aquarius. The brighter starre in his mouth, hath the quality of Venus and Mercurie. But those stars placed on the body of the same, are agreeable and a like to the nature of Saturne.

These hitherto for the images placed on the North and South side of the Equatoure.

5 By the fift, is the declination of the parts of the Eccipticke from the Equatoure, as at the bound from which it is knowne, and both the declinations of the stars, and the latitudes of places learned. The declinations of the stars are called the distances of them from the Equatour, toward either of the Poles of the worlde. The latitudes of places, the spaces from the Equatoure vnto the highest of them raised in the Meridiane, as by the toppes gathered and learned, in the standing right ouer. Also by the Equatoure doe we learne the declinations of the Planets, as well Northerly, as Southerly moued, as more evidently doth appeare, in the solyde Sphere or Globe. So that by the declination of the stars knowne, a man may easily place them in proper instrumentes, by which greate utility ariseth. And it is the measure of time, in that the length of the naturall day is knowne thereby.

6 By the fift is learned, that in the same Cycle (as by the subiect) is both the length of the whole earth, and particular places standing in diuers parts of the earth, considered and measured. For according to the exact doctrine of the sphericall tryangles, the longitude or length of places, and the difference of longitudes is alwaies the Equinoctiall Arke, and not any Parallell. By it also the declination of any degree of the Zodiacke is knowne, which
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being had in any day at none (the sun then shining cleare forth) the Northerly latitude or elenation of the Pole of any Towne, may artificially be knowne. It is besides the measure of time, in that a naturall day is perfourmed by one whole returne of the Equinotiall, with an adition or increase to that parte of the Ecclipticke, which the sun in the meane whiles accomplisheth by his proper motion, against the motion of the first mouer.

7 By the seuenth, it much auaiileth and helpeth the doctrine of astrology, in that by the guide and leading of the same, are the beginnings of the twelue houses of heauen found, when astrologiall figures are erected and fashioned to prognosticate or iudge by: which can neuer so perfectly be searched and found without the Equatoure, and this through the vnlike motion and ascension of the parts or signes of the Zodiacke. By it also are all Townes according to their longitude and latitude, easily placed and found in the earthly Globe: so that by it a man may readily know which Townes are Northerly, and which Southerly. It hath besides a most great vse in Geography, vnto finding the distances of places, and vnto placing of Cities in the earthly globe, in hauing the true longitude and latitude of them.

8 The eight instruction, that by it a man may attaine the knowledge of all the celestiall Parallell cyrcles, and the earthly Zones lying vnder them. As by this example, the Parallel streached along by Rhodes, cannot otherwise be knowne, but by his distance from the Equinotial as by his principall & soze noted Parallell: which a man may learne and know to be from the Equatoure, toward the North 36. degrees. The same knowledge may aptly be had, of all the other Parallell cyrcles rightly knowne, so that none (otherwise) can bee prompt and skillfull in Geographiall matters. Cleonedes affirmeth (prima Meteor) that it afterwards behoueth to know how to discribe

each turning about of the fixed stars with the first mouer, about his Center cyrcle, as that all the Parallell cyrcles are knowne. Seeing among those cyrcles, the Equinoctiall is greatest, and those Parallell cyrcles least which are drawne about the Poles of the worlde: euen the like are those the greater cyrcles according to proportion from them, which are described vnto the Equinoctiall.

9 The ninth sheweth, that no description of the earth, (although in platefourme) can bee expressed, neither by straight nor crooked lines, without the knowledge of the Equatoure.

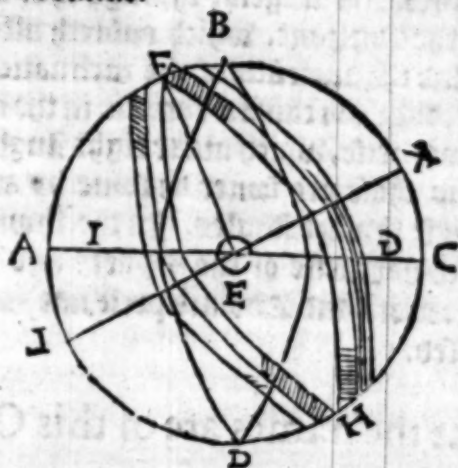
10 By the tenth appeareth, what commodity of the same hath and serueth in the iudging of genitures, is here by silence ouerpasse, seeing with bzenity it cannot be uttered.

The description, names, and offices of the Zodiacke, and Ecclecticke line, or way of the Sunne.



After the ancient Astronomers had deuised heauen into twoe equall halues by the Equinoctiall, and diligently obserued and noted the thwart drawing and standing of the Zodiacke, and a like forme of a larger Zone, the diuers courses, motions, and wandzings, both of the sun, moone, and other Planets which being drawne about with the first mouer, kept no equall spaces in them selues agreeing to the first moouer, nor a like distaunt in their motions from the Equatoure: but that whilest they were dayly drawn by a contrary motion of the first moouer into the East, they in the meane time wandered one whiles into the North, and another whiles

whiles into the South, vnto a certaine elongation and distance, and so returned vnto that cycle. They obserued also that the Planets kept alwaies one manner of iourney and way, and that way cutting or crossing heauen and the Equinoctiall by a thwart manner, the same of these, they named the Zodiacke.



This cycle of the 12 signes, commonly called the Zodiacke (which also is a greater cycle, and thwart lying) hauing a latitude moueable vnto the motion of the sphere to which it fasteneth, and euery where is a like, vnder which the Planettes by a continuall motion are drawne and run.

This cycle also doe the Latines name thwart, through the thwart standing of it: for the Equatour doth compasse the sphere of the worlde, by the iust middle space between either Pole: but the Zodiacke is thwartly drawne both to the sphere of the worlde, and to the Equatoure: so that in some partes it is nearer to the Poles of the same, and in some parts further distance from it. It is crossed also of the Equatoure into two equall halfe cycles; of which the one is called the Bozeall or Northerly halfe cycle, and the other the Meridionall or Southerly halfe cycle: therefore

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by the continuall turning of heauen drawne about, vnto any right and thwart Horizont, inclined according to the thwart Angles, it doeth both chaunge and varie those Angles by the continuall motion and turning about. For to certaine Arks it figureth and formeth righter, and to certaine others thwarter Angles, through that diuers inclination vnto the Horizont, which ensueth after the standing of it. And the diuersitie of the inclination of it vnto the Horizont, doth also cause a varietie in the motion. For those doe slower arise, which make right Angles with the Horizont, and those are swoner drawne by and appeare, which doe cause thwart Angles. In the thwart Sphere, (with that thwartnesse of the Sphere and the Angles, which the Horizont and Zodiack performe) is the thwartnesse encreased.

What the names are of this Circle.

1



This Circle is named the Zodiacke, of this Greeke worde ζωδιον; that is in English Life: in that it is the path, or the coming and going of the sun, which is called the autho^r of life, & causer of generations (as Aristotle w^riteth.) Or of the Greeke name ζώδιον, which in English is the figures of Beastes, with the which this circle is imagined to be formed by the concourse of starrs.

2 This Circle is named thwart or bolwing, in that it crosseth thwartly the Equinotiall and first moouer, and doth appeare thwart in respect of the Poles of the worlde, from which it is not equally distant. Or for that it maketh not right but thwart Angles, with the Equinotiall, and Colures, or Tropickes. Or for that it doeth not regular-
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ly ascend and descend according to his partes (like as the Equinotiall doth) but that certaine parts or signes of the same doe righter and slower; and certaine thwarter and swifter arise in either Sphere. But the Zodiacke is not named thwart (compared vnto the proper Poles) seeing from them it is equidistant according to each parte; as the Equinotiall from the Poles of the world. Yet compared vnto the Poles of the world (in that the one halfe of it declineth vnto the North, and the other vnto the South) and seeing vpon these it is thwartly drawne by the dayly motion, vnto the mouing of the Dybe in which it is: In this respect, is the circle named thwart.

3 This Cycle is also called Signifere, of the 12 signes caried in it, with the which the Zodiacke is described. For that this Cycle is deuided into twelue equall partes, (which are called signes) and each hauing a name of some proper beast: or for the disposing of stars being in the signe. or for some property common to the beast and signe (which Ptholomie nameth the Dybe of the signes) Plinie. Capella, and sundry Poets doe name Signifere: but Aristotle nameth a thwart cycle, in that it doth thwartly crosse the Equatour, as witnesseth Proclus.

What is the cause of the thwartnesse of the Zodiacke.



1 Here are two causes, why the Zodiacke is thwart: the one is, that the neather Spheres vpon the other Cre-tree, and Poles, may bee caried contrary to the motion of the first mouer.

2 The other is, that there may be diuersities of times, and varieties of qualities and temperances:

pearances : that the sun also may wander and goe about diuers partes of the earth, running in the thwart cyrcle; wherof Aristotle writeth, that it is necessary, that the proper motion in the Zodiacke is vnlike to the motion of the first mouer, that it may therby cause the variety of crescent or growing things. For if there were onely one motion, there should no varietie of growing things be caused.

3 A like reason to this, that of the same, one parte of it doeth drawe nigh to the top and highest ouer our heades, and the other, that it is remoued and distant from vs, doth cause most commonly the diuersitie in effectes, which vnto the life of things is requisite. As for example, when the sun is in the southerly halfe of this cyrcle, and neare the Zenith and highest ouer our heades, hee doeth cause a strong and mighty heat on all things of the earth, as by tryall we finde and see in the summer. If therefore the Zodiacke were not thwart, but shoulde equally approach or drawe nigh according to all the parts of it, then should the sun be allwaies a like neare vs. And when in a short time of summer he should cause such a heat, that his heat vndoubtedly should be so mighty, that nothing shoulde growe or bee increased, but that those thinges already growne vp and dyled shoulde bee consumed and burnt vp : wherfore the Zodiack is thwartly placed, that the sun mouing into the further halfe, his heat may thereby be slaked and weakened, in which he being caried departeth from our Zenith, and cold then taken place, as appeareth in the winter. And if the sun shoulde continually run in the South parte of the Zodiack, then through extremity of cold shoulde all things be destroyed in the south part. And as neither heate nor cold is continuall, but successiue, as those which bee engendred and caused by heate, and consumed by colde. So that the sun procureth (by comming nigh, and going from vs) in the Zodiacke, that it behoueth the Zodiacke to be thwart. Also a diuersity of the Planets in the Zodiacke.

To conclude, we see that by the comming of the sun to vs, generation is caused, & by his departure from vs, thinges wither and dye.

This cyrcle called the Zodiack (according to longitude) is deuided into twelue parts or signes, and neither more nor fewer. And according to latitude or breadth, into 12. degrees. This cyrcle deuided into twelue signes, in that of the auncients it hath bene noted, that in euery reuolution of the sun, the moon is twelue time changed and new, and so many times hath hee full light. And that so many changes and full moones doe happen within the compasse of one yeare: by which it pleased them to deuide the Zodiacke into so many parts, according to length. But the diuision of the breadth, hath another cause; that is, of the other Planets, (except the sun) diuersly wandring from the same cyrcle. To be brieft, this whole cyrcle is deuided into 360. degrees, for the commodity of this number; in that the dayes of the yeare excede this number by certayne partes: for the common yeare hath 365. dayes, and 6. houres.

There is a latitude attributed to the Zodiack, by which it differeth from the other cyrcles, in that they are described with one simple compasse, that it might by the larger space, containe the wandring of the Planettes, on either side the Ecclypticke line, least they should exceed the bonds. Yet the sun keepeth one maner of way and iourney continually in the middle of the Zodiacke, and neuer declineth from it, neither vnto the right nor lefte side, but still keeping his proper places immoueable; both in the rising and setting in either quarter, and is all alike in the winter and summer seasons. The declinations also of the sun, do shew and appeare to be equal, being on either side the Equator. So these doe witnesse, that the sun continually in his yearly motion, describeth and keepeth vnder that line named the Ecclypticke. But the other Planets doe neither keepe

continually the suns way, noz is drawne in a right path like him, but digressing on either side the suns way, doe wander the Zodiacke by a crooked or bending course; as one whiles moued into the North, and another whiles into the South: and from thence returning vnto the sunnes way, as the like knowledge may be had and discerned by the cie.

For this cause, the learned practicioners described the suns course in the middle place of the Zodiacke, and imagined from it a latitude to be attributed to the Zodiacke, which the auncient astronomers determined to bee of either side 6. degrees. But the late writers haue encreased the same, by adding twoe degrees to either side, through the digressions of Mars and Venus from the sunnes way; which hath bene obserued and noted to digresse and decline little lesse then eight degrees. So that the latitude of the whole Zodiacke (in our time) is concluded and agreed to bee of 16. degrees, and the latitude is reached on either side, from the middle space of the suns cycle towarde the Poles of the Zodiacke, eight degrees.

The beginning of the longitude of the Zodiacke (although in the compasse of the circle, neither the beginning noz end can be assigned) which bendeth or is drawne perfectly round into it selfe; and both closeth and containeth it selfe: yet the practicioners haue assigned by the principall and most auncient doctrine of the godly fathers, to bee in the point of the Equinotiall spring, which is by the suns coming vnto the Equinotiall poynte: or truer by the change of the mone that followeth nexte the Equinotiall spring, is not to be doubted that the yeare then begun. So that they began to reckon the Zodiacke from that pointe, where the motions and workings of the sun (the authour and sheffer of the yearely space ensued) which after the day and night being alike, the day encreaseth, and he ascending to vs ward, doth after abate the cold on the earth, and

and both maketh and melteth the frostes and yce, and the hidden vertues againe of the earth, hee then beginneth to lose, open, chearish, and stirre vp by his liuely heate, and both loseth and sheadeth forth the dew moisture inclosed; and draweth vpper and procureth young plants to spring, through his comfortable warmth dayly shewed vpon the earth.

They deuided the whole Zodiacke according to length into twelue equall partes (which they named signes) through the moone as guide and ruler of the same: which passing yearely by the Zodiack 13. times, to the suns slower going twelue times; & conioyned with him in twelue places of heauen. Those signes the ancient Greeks name *zodia*, either by the figures of creatures, (which the fixed stars in their standing shewe and expresse) or by some naturall agreement, they so assigned names to them. Besides they appointed the names of beasts to the signes, through the congruent nature betwixt starres and beasts. Also through the effects which the sun hath in those places. Besides these, the auncient astronomers described the other starres without the Zodiacke by images, that placed into images, they might be the commodiousest taught and expressed in heauen to the vnderstanding of yong students, and that their rising and setting might also bee the more readily demonstrated. Ptholomic named those *Dodekate-moria*, that is, the twelue parts. The Latines called them signes, and constellations. Also they named those partes signes, so: that in those twelue parts, all the seasons of the yeare are noted. Again they named the parts of the signes degrees, of the dayly iourney of the sun in the Zodiack, so: that in iourneying by litle and litle, he passeth through the whole Zodiacke.

They also deuided each signe into 30. parts or degrees, through the suns dayly iourneys gained of the first mouer, which in thirty dayes they declare by experience, to haue mea-

measured and gone almost a twelfth part of the Zodiacke. **D;** so; that the space from one conimention vnto an other is of 30. dayes, which space (of all wryters) is named a moneth. **D;** else in that the sunne by the same number of daies, hath measured almost this Arke or space of the Zodiacke. Whereof they named the selfe same, the thirty part of a signe, throught the suns motion euery 24. houres, which the later Latines call *degrés*, and the *Greeks* *Μερε*, that the ancient call parts. But the tenne partes or *degrés* of euery signe, the *Greekes* name *Δεκάτας*, and the Latines *faces*; of which each signe both conteyne thre.

The names and characters of the signes of the Zodiacke, are these *♈* Aries, *♉* Taurus, *♊* Gemini, *♋* Cancer, *♌* Leo, *♍* Virgo. These in that they make the halfe cycle of the Zodiacke, declining into the North from the Equatoure, therefore doe they name them, the Bozeall and Northerly signes.

The names and Characters of the other signes of the Zodiacke, are these. *♎* Libra, *♏* Scorpio, *♐* Sagittarius, *♑* Capricornus, *♒* Aquarius, *♓* Pisces. These in that they possesse the opposite place, and the halfe cycle reaching into the South of the Zodiacke: therefore do they name them, the Peridionall and Southerly signes.

The sunne also iournepeth by these signes (as from the West into the East) by a contrary order to the first mouer, as this figure plainly demonstrateth: beginning neuerthelesse at Aries, and from Aries, passing into Taurus, and from Taurus into Gemini, and so to the ende of the signes.

They



They deuided each signe, into 30. degrees of length, in that the whole Zodiacke (like as the other greater or lesser cyzle) containeth 363. parts, or degrees. And as the Zodiacke hath in length 12. signes, euen so it is requisite the same should be so many degrees broad (as Capella twi- teth. And as a degree is in the signe the thirtieth parte or length, the compasse of the whole Zodiacke should be the like in breadth. Although Mars and Venus do sometimes digresse from those bonds, yet that excelle is litle, and ver- ry seldome: and there can bee no other reason of the same, then that such a latitude is permitted, or assigned to the Zodiacke.

To this demaund, why there are onely twelue signes, and no more, doeth Albumaser answer: affirming, that the first obseruers of the stars, noted 48. images in the 8. heauen, placed and decked with the stars, that represent sundry formes, and called by them, for the form, standing, or nature of the stars, of which they appointed 12. for the sunnes way: and therefore so many, are the signes of the Zodiacke. But here may bee demanded, where the Cir- cumference of the Zodiacke is, to which is thus answered
that

that all the circumferences of the cycles imagined are in that hollow of the first heauen, and likewise the signes are conceiued there to bee. And where the signes with the images of the eight sphere are moueable, and the starres in them seperated after a time. Yet the number and names, both of the signes and images remaine. So that it is not materiall, if that the starrie Aries seperate from the first Aries of the zodiacke, and the other signes the like from one another, by a most slowe course are caried, and seperated.

The auncient men deuided the partes or degrees of the signes into lesser portions, for the better attaining the precise point in the suns place. So that they appointed to each degree 60. minutes, to each minute 60. seconds, to each second, 60. thirdes, &c. For the infinite commodyty of the numbers in calculating, by reason of multiplication and diuision.

They also deuided the signes after two conditions, as in the standing, and qualities. In the standing, they distinguished them into principall, fixed, and common signes.

The principall and moueable signes, are those which highest succede the foure principal points of the zodiacke: of which two possesse the Equinoctiall points of the whole cycle (as Aries and Libra). The other two highest to the Solstitiall points, are named the Tropicks (as Cancer and Capricornus.) The firme or fixed signes, next to the principall, are Taurus, Leo, Virgo, and Aquarius. The common, or meane (or of two bodies, being the other foure) which placed (as in the middle between the principall and fixed signes) doe so obtaine a common nature of both, as Gemini, Virgo, Sagitarius, and Pisces.

In the qualities, they assigned them into foure Trients, which the Latines name Tryangles, and these cornered the common writers nameth Triangularites, or Triplcities

cities. The first trient containeth Aries, Leo, and Sagittarius, which are by the space of foure signes inclusively distant, 02 of 120. degrees: that are hot and drye, fiery, cholericke, and masculine.

The second Trient comprehended Taurus, Virgo, and Capricornus; which beeing distant by the like space, are colde, and drye, earthly, melancholicke, and feminine.

The third Trient hath Libra, Gemini, and Aquarius, which beeing distant by the space of foure signes, are hot and moyst, sanguine, aereall, and masculine.

The fourth Trigon 02 Trient, doeth containe Cancer, Scorpio, and Pisces, which are distant by the space of foure signes, and are in quality colde and moyst, waterie, flegmaticke, and feminine. All which signes, are agreeing to the foure Elements, in their qualities.

Of the Ecclipticke line, or way of the Sunne.



ere it is diligently to be considered and noted, that it becometh not only to know and vnderstand the places of the Planets in the Zodiacke (according to the longitude of the same) but also to learne and finde their places (according to latitude) wheather they be in that part of the zodiack which bendeth 02 declineth into the North, 02 in that parte which leaneth into the South: which the better to vnderstand and know, the ancient astronomers imagined a certaine line, going rounde about the zodiacke, and deuiding the same after length by the middle, in such sorte, that it parteth and leaueth eight degrees toward the North, & as many toward the South. So that this line is a greater cyrcle, deuiding the latitude
of

of the zodiacke into twoe equall halfes, and hath sundrie names: as the suns way, the suns cyrcle, the suns iourney, the suns place, the suns cyrle, the Ecclipticke line, and the Ecclipticke place.

This line named the suns way, in that the sun keepeth alwaies the middle vnder this line, not digressing to the one side nor other: but describeth the same in his pearely motion. But the other Planets doe wander one whiles vnder it, and an other whiles on either side, which if a Planet tendeth in that part of the latitude which is vnto the North, wandring there, hee is then named to haue a latitude Northerly, as to vs dwelling Northward: but if on the other side they haue a latitude Southerly, then are they named discending and running lowe,

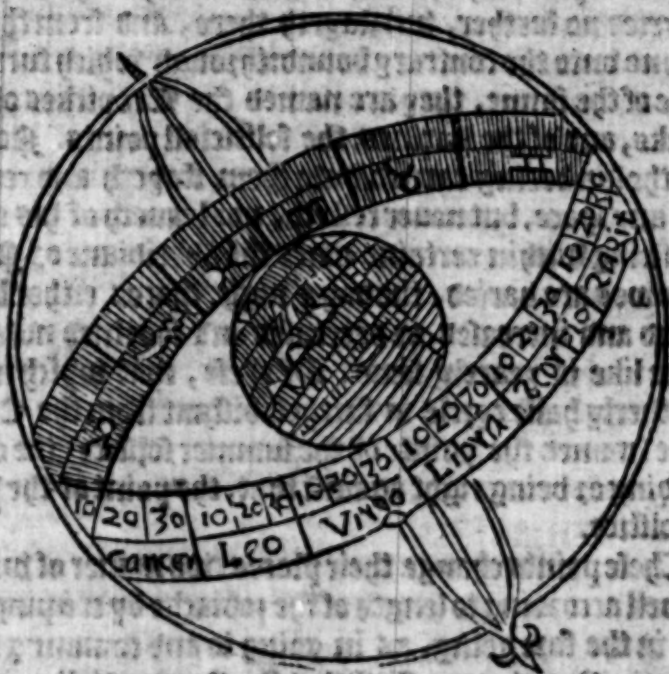
And by the like reason, the same line is named the suns iourney. Also of Cleomedes, called the suns cyrcle, in that vnder the same the sun continually runneth. And he alone being drawne by the middle of the zodiacke, neuer wandreth into the North nor South parte from that line (as we haue afore written) but continually iourneyleth about by the middle of it. So that of the same, it is called the suns cyrcle.

It is named the suns place, in that vnder this cyrcle the sun continually abideth.

To conclude, it is named by the vsuall name the Ecclipticke line. For that no Ecclipse or abating of the suns or moones light hapneth, but when the sun and mone are linally vnder that line (or neere come vnto the mone) as in the same degree right against. For in the same degree, at the chaunge, is the mone come right betweene our sight, and the suns body; thereby abating his light. But the Ecclipse of the mone hapneth at the full, when as the sun is right against the mone; & that the shadowe of the earth falleth between both, whereby the moons light is darkned. So that the moones Ecclipse is none other, then the falling
of

of the earths shadowe betwene the sun and mone.

The measure of the large space of either side, occupied by the Planets, limited and included by twoe lynes, and the third drauone or described by the middle, is named the Ecclipticke line, and suns place.



The Eccliptick line is a greater cyrcle consisting in the middle of the Zodiacke, and deuiding it into twoe equall compalles, defined to be eight degrees in breadth on either side, which the sunne maketh by a yearly motion, going thwarthly in one continuall way, is deuided by the foure principall points; as the two Equinoctials, and the Solstices, into foure quarters. For as the whole Zodiacke, euen so the Eccliptick to the Equatour, resting as it were in two onely points, but in the rest of the cyrcle it bendeth from either point toward the opposite Poles of the worlde

de.

declined by the one halfe cyzcle into the North, and by the other halfe into the South.

The pointes that touch, are the Equinotiall (as wee haue aboue written) but the other two, furthest distant from the Equatoure (which are as markes or boundes for the suns departure) that when he commeth to the one, he is carried no further, but stayeth there, and from thence drawne vnto the contrary bound: through which turning backe of the sunne, they are named the Tropickes of the Grecks, and of the Latines; the solsticiall points. Not for that the sun beeing carried vnto them, stayeth and remaineth any space, but neuer resteth, nor leaueth of his courses: seeing within certaine daies the Peribiane or some shadowes are varied, the day & night spaces either lengthened and increased, or decreased and shortned notably: as the like is yearly sene. Of these, that which in the Northerly halfe cyzcle is furthest distant from the Equatoure (named the pointe of the summer solstice) the other standing or being right against that, the point of the winter solstice.

These points change their places two manner of waies, as well according to length of the zodiacke by creeping further in the soze going, as in going to and coming short vnto the Equatoure. First that the Equinotiall pointes, doe ouer go the places of the fixed stars, against the order and course of the signes; and therefore doe the dates of the solstices begin and goe before. For the summer solstice about the beginning of Olimpias the first day of July, which began the yeare with the Grecks at the morning rising of that constellation Syrius, being notably knowne to many: but in the yeare of Christs birth, it hapned in the 24. day of June. And in the yeare 1570. it hapneth in the 12. day of June, about 11. of the clocke before none. The winter solstice in the first beginning of Olympias, hapned the first day of January, or there about. In the year of Christs birth

by:th it hapned the 15. day of December (in which day at the houre of 12. in the night, they affirme our sauiour to bee bozne. The same winter solstice hapneth in the same yeare 1570. on the 12. day of December, aboute 2. of the clocke at after Noone.

In the second they happen vnto the Equatoure by the Ecclypticke (as it were winding) and remoued againe in the same departing. For the obseruations of many times doe witnesse, that the arche of the Colure of the Solstices reached to these points and Equatoure (which they name the suns greatest thipartnesse or declinatio) is deminished by little & little. For before Ptholomies tyme by forty yeeres Aristarchus, Samius, founde the same to bee of 23. degrees, 52. minutes, and 20. seconds. And Ptholomie noted, that he found it to be iust asmuch.

Mahometes Aratenis which was after Ptholomie 749. yeares, found this declination to be of 23. degrees, and 35. minutes.

Arzahell the Spaniard that was 190. yeares after Albategnius, found it to be of 23. degrees, and 34. minutes.

Prophatius Iudius which was 230. yeares after Arzahell founde this declination to be of 23. degrees, and 32. minutes.

Dominicus Maria being in the yeare of Christ 1491. found this declination to be of 23. degrees, and 29. minutes.

Vueruerus being in the yeare of Christ 1514. found this declination to be of 23. degrees, and 28. minutes, and 30. seconds.

Copernicus being a later writer, as in the year of Christ 1525. found this declination to be of 23. degrees, 28. minutes, and 2. fifths of a minute.

Of these (but by many notes considered) that the equalities haue decreased by the regular motion, and yet shal decrease, vntill an extreame tearme of diminishing ensueth, which hee affirmeth to be of 23. degrees, and 28. minutes:

minutes: the same Copernicus after gathered that againe increase; and that the greatest thwartnesse which may bee caused on the sun or Ecclypticke line, is 23. degrees, and 52. minutes: & the least declination to bee of 23. degrees, and 28. minutes. So that hee stablished the difference of the greatest and least to be of 24. minutes. But hee defineth the periedic motion of the increasing or diminishing to be in 1717. yeares: and that so many yeares, the motion of the decrease and increase shall be, and that the whole restitution also of the thwartnesse, to be in 3434. yeares. So that as the thwartnesse fading or diminishing: euen so the points of the greatest declination (which are named the solstices) are yearly or at one and moued nearer vnto the Equatoure by 6. minutes, 27. seconds, 24. thirdes, and 9. fourthes: but dayly by one second, two thirds, and so many fourthes, caried neare vnto it. And the thwartnesse increasing, may by the like order and condition, and in the same motion be againe abated.

As the Equinotiall points deuide the Ecclypticke lyne into a southerly and southerly halfe cyrcle, euen so the solstitiall pointes parte the same into a halfe cyrcle (ascending and descending) as to vs. The ascending beginneth from the beginning of Capricornus, and endeth at the last pointe of Gemini, and containeth Capricornus, Aquarius, Pisces, Aries Taurus, and Gemini. And the descending from the beginning of Cancer, reacheth vnto the end of Sagittarius, and comprehendeth Cancer, Leo, Virgo, Libra, Scorpio, and Sagittarius. So that the sun in that halfe cyrcle, ascendeth from the southerly region vnto vs, in that from vs it is digressed into the South, and of the same they receiued those names.

What

What the latitude of a Planet is,
after two definitions.



First, that the arke of the great cy-
cle is crossed betwene the Ecclip-
ticke, and true place of the Planet,
(and that is named the latitude of
the Planet) for that according to
the same, the Planet into latitude,
that is, into the South or North,
swarueth from the Eccliptick line:
whereof the Planets are named to
haue a latitude, one whiles into the North, and another
whiles into the South. But the degree expresse and the-
wed by that great cyrcle in the Eccliptick, is called the de-
gree of the longitude of the star or planet, which according
to longitude from the beginning of Aries vnto that place,
is the Planet moued.

The other instructeth, and by demonstration sheweth,
that from this line the other fine Planettes wander, one
whiles into the North, & another whiles into the South
beeing not equally caried. This wandring from the saide
line, is named the latitude of the Planets, and is the arke
of the great cyrcle, passing by the Poles of the Zodiacke
and true place of the Planet, comprehended betwene the
Ecclipticke, and Center of the star. According to this di-
stance, he is named a Planetary star (what star soeuer the
same be) that to latitude from the eclipticke, is carried
either Northerly or southerly. So that it cannot be saide
that a planet is without the Zodiacke, seeing the aunient
obseruers of the stars (being moued) did attribute to this
cyrcle a latitude. As may be (the Ecclipticke line) noted
with A. and B. and the letter C. the Pole of the North-
ly Ecclipticke, by which the Cyrcle noted with C. G. D.

I y.

and

aboue, where the pointe A. representeth the beginning of Aries, the letters A. G. the longitude of the star, if the same shall bee in the Ecclypticke, the letters C. G. D. the cyrle ending the longitudes.

The difference betwene a declination and latitude : is this, that a latitude is the distance of a star or Planet from the ecclyptick, toward either of the Poles : which distance is measured in the greate cyrle drawne by the body of a star, and Poles of the Zodiacke.

But the declination is a distance from the Equinotiall, when as the sun is caried by a continual and dayly course in the vpper face of the Ecclypticke, and hath no latitude, but a declination onely : yet the other fixe Planets, haue a latitude and declination. The declination of Planets, is the distance of them (or a degree of the ecclyptick) from the equinotiall. And this measured by the cyrle drawne by the body of a starre, or degree of the ecclypticke, and by the Poles of the worlde. The Planets also are said to ascend and descend, by reason of the thwartnesse and bending of the Zodiacke : for the sun doeth ascend in the Northerly signes, but hee descendeth in the Southerly. In the like maner doe all the other Planets, as well by the reason of the ascention, as also of the place. For planets beeing in Northerly signes, haue the arke of ascention greater than in the Southerly. Besides, this part of the world which declineth into the North, is supposed and iudged as to vs, to be raised higher, by reason of the Horizon.

Further the definition of a signe shall here bee declared, that the same is ment sundry wayes : one whiles to bee a circumference, an other whiles an vpper face : and sometime to be a solyde body.

The Zodiacke (as I haue afoze declared) is one whiles a lineall circumference (which is named the Ecclypticke line) an other whiles a swathe, of eight degrees in breadth of either side: Sometimes the zodiacke is called the plain

upper face of that Ecclipticke: and in an other place the same called a solyde body, which of the saide swathe, and by the two imagined upper faces is crossed; of which the tops or highest places ouer the head are ioyned together in the Center of the earth, and the feete are those Parallels of the Ecclipticke ending the swathe, which may worthily be called a solide zodiacke.

The being in a signe is ment six waies, in that the circumference of the ecclipticke (as I haue afoze witten) is deuided into twelue equall arks, which are called signes; and the signes ment in the first maner. Those then drawn and imagined in length by the Poles of that ecclipticke line, and by the pointes of the crossings, yet by great cycles, as that circumference of the ecclipticke: and so the zodiacke vnderstode and described of those, in the other five maners or waies, is deuided into twelue equall portions, whose signes are taken and ment so many waies. A signe therefore in the first maner, is mente the lineall circumference; but in the second maner the square portion of the superficiall Sphere included with foure arks: of which two are of the Parallels of the ecclipticke, and two of the cycles deuiding, and the one ending againe in the others. A signe in the third maner, is the deuider of the circle taking here the circumference, which signe is vnderstode in the first maner. A signe in the fourth maner is a certain square (pinacle wise) hauing the sharpe end turned downwarde to the Center of the worlde, and included with foure deuiders, the foote or broader end reaching vp to the sphericall upper face; which is a signe ment in the second maner, as this figure more plainly demonstrateth, where the letters A. B. doe represent the Poles of the Zodiacke, the letters A. D. B. and A. E. B. the Cycles drawn by the Poles, the letters E. and D. doe represent the twelue part of the ecclipticke; the letters G. and K. or F. and H. expresse the latitude of the zodiack: the letters A. and E. doe shewe the signe in the



the first maner: the letters F. K. doe represent the square portion in the second maner: the letters C. D. E. witnesse the deuider in the third maner: the sharpe pinnaule (whose top or ende is turned downewardes) and the letter C. the fote of the squares: the letters F. K. do represent the portions in the fourth maner: the letters A. D. B. doe expresse a portion of the Sphericall vpper face, betwene the halfe cyrcles. The letters A. E. B. doe shewe the portion in the first maner: the solide deuider between those halfe cyrcles is expessed in the first maner.

Further a signe in the fiste maner, is a portion of the sphericall vpper face (inclosed betwene two halfe cyrcles) ended at the Poles of the ecclipticke. To conclude, a signe in the first maner is mente a solyde deuider of the Sphere, contained in the saide halfe Cyrcles and Sphericall vpper face, which is a signe vnderstood in the fiste maner.

These diuers diuisions serueth (as they write) vnto that end, whereby all things might be inclosed within the signes. For if signes be described in the first maner, then on such wise those stars onely, and those points are said to be in the signes, whatsoeuer shall be in that cyrcumference of the ecclipticke. And in the first signification also is ment to be vnder the ecclipticke, which agreeth onely to the sun, as at this day the sun is (beeing the 23. day of August) in the 9. degree, and 9. minutes, of Virgo at Pone, which is

3 lig.

ment

ment to be vnder that part of the eccliptick, that is named the 9. degree of Virgo.

If in the second maner planets shall be in signes, which doe not exceede sixe degrees of latitude; or thus in the second signification, to be vnder the zodiacke is mente, that here a signe is exprested, inclosed within a square pinnacle position. This signification agreeth to the other planets (except the sun) which decline from the ecclipticke, as Mars in this yeare 1599. is in the 15. degree of Virgo, which is vnder that parte of the zodiacke, that is saide to be the 15. of Virgo. Also he hath a latitude southerly of two degrees, and 28. minutes.

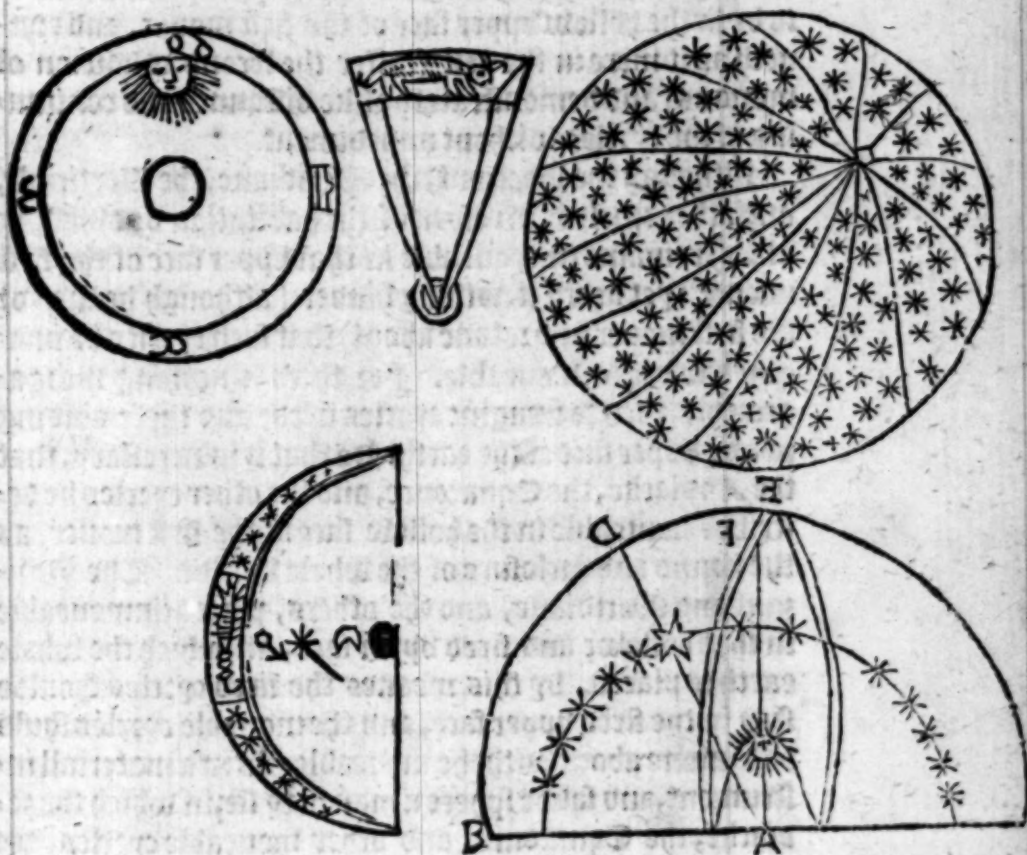
If in the thirde maner, the sun or any starre shall bee in signes (placed in the plain of the eccliptick, or in the third signification to be in a signe) signifieth to be referred vnto any signe of the zodiacke. For the whole heauen is deuided into twelue Regions (in cyrcles passing by the beginnings of the signes, and Poles of the Zodiacke) of which Regions each is named a signe. And this signification agreeth to the stars, standing without the zodiacke: as the southerly Crowne, which in our time is in Scorpio, and referred vnto the signe of the zodiacke that is called Scorpio; in that it is betwene those twoe halfe cyrcles which passe by the beginning and end of Scorpio.

If in the fourth maner, the planets and stars also, not farther distant then sixe degrees from the ecclipticke. Or in the fourth signification, is ment or referred vnto any of the twelue Regions of heauen; into which, heauen by those sixe Cyrcles which passe by the beginnings of the signes and Poles of the zodiacke (as is afore written) is deuided. This signification agreeth to those which are in the ayre, (as be the Comets.) As if I wrote that a Comet were in Leo, here I meane the sixe cyrcles passing by the Poles of the zodiacke, and beginnings of the signes, deuiding both heauen and the whole neather Region of the worlde into twelue

twelve equal partes. So that a Comet is saide to bee in Leo, seeing it is in that twelve parte which the twoe halfe cyrcles describe, running or stretching by the beginning and end of Leo.

If in the first maner, all the stars and points ment in the vpper face of the sphere, be included in signes. If in the first maner, then whatsoener is in the world (whether the same be in the Ethereall, or Elementarie region) is accounted to be included within a signe.

Here is further to be noted, that the starres may otherwise be receiued into signes, or inclosed within signes, be



sides these sundry deuisions. For the deuision of the Eccipticke, alone were sufficient, that a star or any point be so brought vnto his signe, that the same may be said to bee in the signe. As by a like example the preposition (in) vsed for the worde (*sub*,) in English (*vnder*.) So that if the sun were saide to be in Aries, then is the same ment to bee and run vnder Aries. And for a more readier and easier conceiuing of the former lesson taught, vse the examples befoze demonstrated.

Here conceiue, where the cycumferences of the cycles are ment. And first imagine the circumference of the Zodiacke, and all the other cycles (as I haue afoze witten) to be in the hollow vpper face of the first mouer, and runneth as it were in the first (after the second condicion of motions) and demonstrateth alike distaunce and continuing of the cycles without impediment.

Although the Horizont, the Meridiane, the Verticall, and other cycles (in respect of the habitation or dwelling place) remaine immoueable in that vpper face of the first mouer: yet doeth it nothing hinder (although heauen or the first mouer be drawne about) that such cycles be imagined to bee immoueable. For there is nothing more agreeable, then to imagine cycles fixed, and those abiding in any vpper face of the earth. So that it is necessary, that the Zodiacke, the Equatoure, and the other cycles be described moueable in the hollow face of the first mouer, as the bound and inclosure of the whole worlde. The Horizont and Meridiane, and the others, placed immoueable in that hollowe and fixed vpper face, in which the whole earth is placed, by this meanes the fixed cycles shoulde stay in the fixed vpper face, and the mouable cycles shuld be drawne about with the moueable. As in a materiall instrument, and solide sphere a man may see, in which the zodiacke, the Equatoure, and other moueable cycles, are drawne about vpon the Cre-tre, betwene the two Cycles

cles remaining Steady, of which the one representeth the Horizon, the other the Meridian.

Whether the same may be described in the hollowe, or in the imboling of the first moouer of the saide cyrcumference, it is little or nothing regarded: yet consider this, that all men may behold and see within the heauen or first mouer, the hollowe vpper face of his inclosure, to describe and imagine the cyrcles in the same.

The Cyrcles placed without the materiall instrument, must of necessity force a man to describe the cyrcumferences of the Cyrcles in that outwarde face of the Instrument.

To conclude, the Zodiacke is ment and described according to his diffinition (being a greater Cyrcle) whose cyrcumference in the hollowe of the first moouer described into signes, degrees, and minutes, (as was afore written) is deuided. And seeing that Cyrcle described by the suns yearely motion, is imagined straight or drawne and defined or determined from the Center of the suns course by the Center of the sun, which with the sun is drawne by a perfect reuolution toward the East.

For this line in that motion cutting the hollowe vpper face of the first moouer, doeth describe the cyrcumference of the Zodiacke. So that if the plaine vpper face of the suns course be extended, vntill it cutteth the foresaide hollowe vpper face, which common section or cutting shall be the selfe same cyrcumference of the Zodiacke, vnto which the place of the force and vertue of any star is applied. Therefore by the same meanes that vertue of the moone, or any of the planets, drawne in the same hollowe of the vpper heauen, shall be like the same described.

What

What are the vses and vtilities of
the Zodiacke and Ecclipticke.



The vtilities & vses that this cyrcle offereth to the studious in this art, shall here briezely be vttered.

1 It is the way, rule, and measure, of the proper motion of the planets.

2 By the benefit of this cyrcle, the true places of the stars (aswell the planettes, as fixed starres) are found. By the same also may the learned know, in which signe the planets and fixed stars are named to be.

3 This circle sheweth the latitudes of the planets and fixed starres; the knowledge of which is greatly profitable.

4 The speciall vse of the ecclipticke is to finde out the times both of the rising and setting of the planets and fixed stars. For all are in the greatest cyrcles, being drawne by the places of the stars, and Poles of the ecclipticke and appropriated vnto the points of the ecclipticke, which those placed without the plaine of the same, doe behold toward either of the Poles. For the true places of the starres doe differ in the Ecclipticke, from them with the which they rise and set.

5 Of these cyrcles, there are certaine with arks, which lie betwene the true places of the starres and ecclipticke, and aswell shew the true places of the starres, as their distance from the plaine of the ecclipticke; which the Greeks call *Platos*, the Latins, latitude, in certain places in which they are caried so;th, after their short course ended, and set vnder the West. Also the stars are referred vnto the Ecclipticke thzough the sun, which is caried in the same cyrcle,

cle, and causeth the diuersity of times, and differences of daies and nights; besides, it doeth temperate by a merue-
lous varietie, and moderatesh and ruleth the other cour-
ses.

6 By vse and experience we are taught, that vnder the
ecliptick is caused the Ecclipses both of the sun and moon,
of which this line came so called, for the eclipses of the sun
alwaies happen at the moones changes, and of the moone,
at her opposition to the sun.

7 The thwartnesse of the Ecclipticke, as I haue afoze
declared, is the cause of the vnequalnesse of the artificiall
dayes and nightes.

The description, names, and offices, of the Colures.



That called a Colure, is defined to
bee a greater Cycle, turning or
dratone by the Poles of the world
which as vnto the motion of the
Sphere is moueable: and certaine
partes of it in the thwart Sphere,
continually hidde vnder the Hori-
zont.

This cycle termed a Colure, is so named of the Greek
worde *Kolouron*, which in English signifieth mutilate and
vnprefect, in that this cycle alwaies appeareth to vs vn-
prefect. But a readier knowledge of this cycle is, that in
the thwart Sphere certaine parts of both the Colures, are
nothing at all seene, in that they neuer arise to our sight,
but are alwaies hid vnder the Horizont: where the other
cycles of the Sphere (in the respect of which the thwart
sphere riseth aboue the Horizont in the turning aboute of
the sphere) are seene to vs in euery 24. houres. Also more
or lesser of the Colures, are hidden vnder the Horizont, ac-

according to the diuers eleuation of the Pole, whereof the Colures are called vnperfect cyrcles.

There are two maner of Colures, as the Colure of the solstices, and Colure of the equinotials. These two greater cyrcles are drawne by the Poles of the world: of which the one goeth by the Poles of the Zodiacke, and the other by the sections of the Zodiacke and Equatoure. That which passeth by the Poles of the equatour and Zodiack, doth deuide in two parts each halfe cyrcle, as well of the equatour, as the Zodiacke. Therefore the one condicion of the Colures goeth by the solsticiall pointes of the Zodiacke (which are the beginnings of Cancer and Capricorn, and the furthest pointes from the equatour) whereof it is named the solsticiall Colure. The other is named the equinotiall Colure, seeing it entreteth by the saide equinotiall sections, which are the beginnings of Aries and Libra; that is, the equinotiall points. So that these Colures deuide aswell the equinotiall as the Zodiacke into foure quarters, in that they goe by the foure principall poyntes of them.

The Colures generally are called al the greater cyrcles drawne by the Poles of the world, which take their name thereof, insomuch as they neuer are discerned or scene whole in the turning about of the worlde, as the other cyrcles, but vnperfect and lacking. For both the arks right against one another about the Poles, in the thwart sphere are not scene both at once.

For they are either continually in sight to vs, and neuer drawne away or hid like vnto those which be neare to the eleuated Pole. Or else they neuer appeare in sight to vs, but are continually hid from vs, as those which be the opposites.

But the reaching of the Colures fastneth in the two circles, extended and passing by the foure principall pointes of the ecclipticke, as the equinotials and solsticials, which
 tou

touching one another in the Poles of the world, do in their cyrcumferences make right angles, and part the Zodiack and equatoure into foure equall quarters. The Colure of the equinoctials, resting in the equinoctiall points. The other containing the solstiticall pointes, is called the Colure of the solstices,



The Colure of the equinoctials is a greater cyrcle, moveable, and every where alike: drawne by the Poles of the worlde or equatour, and the equinoctial points, as the beginnings of Aries and Libra, making with the equatour right sphericall angles, with the Zodiack thwart angles. For oftentimes the greatest cyrcles (by a mutual touching together) doe make right angles in the sphere, as they cut in two parts or into equall halfe cyrcles, and by the Poles one another: and contrariwaife when they cutte one another by the Poles, then doe they soyme and make right angles with their cyrcumferences, and part one the other into equall parts (as writeth Theodosius in his first Booke de Sphæra, and in propositi, 18. 19. 20. and 21.)

Or thus, the Colure of the equinoctials (which is named the equinoctiall Colure) is a greater Cyrcle passing
by

by the poles of the world, and the first pointes of Aries & Libra; where the two Equinoctiall points are said to be: in that the sunne causeth a like day and night in every place; or so that these pointes are in the Equator, where of it is called the Colure distinguishing the equinoctials: so that the two Colures crosse one another on the Poles of the world, at right sphericall Angles.

It is called the Colure of the equinoctials, so that it passeth by the equinoctiall pointes, as by the beginnings of Aries & Libra (which they call the Equinoctial pointes) so that when the sunne hapneth into either of them, the day and night is of equall length throughout the Earth; which commeth to passe twice in the yeare (as in the Spring and Haruest) whereof the one is called the Equinoctiall spring (and at this day is about the eleventh of March) which is the day before Gregory: the other, the Haruest Spring, and hapneth in our time the 14. of September, that is, three daies after Lambert, whereof ariseth this auncient verse:

Lampert, Gregori, nox est æquata diei.

The Colure of the Solstices is a greater circle, moveable, and every where alike drawn by the solsticiall points or the beginnings of Cancer & Capricornus, and the Poles of the Zodiacke and Equatoure, making right sphericall angles with both, so of both is the Poles comprehended. And according to Theodosius propo. lib. 2. de Spera, that by any twoe cycles crossing one the other (when a thirde devideth the parts of both equally and in two partes) the same is the greater cycle, and passeth by the poles of both. But that which passeth by the Poles of the other Cycle, doth part it in two parts, and at right angles.

Here may be demanded, why the other twoe are called the solsticiall pointes, seeing the sunne stayeth no where. Which is thus answered, that the sun digressing from either equinoctiall poynt by his proper motion, doeth dayly

de

Depart from the equinoctiall cycle, till he come vnto the solstitiall point, where he is furthest distant from the equatoure. But immediately after hee beginneth to returne and come againe vnto the equatour, till he come vnto the other equinoctiall point. So that the pointe of the suns furthest distance (which is the beginning of Cancer or Capricornus) and of the same called the solstice, in that the sun stayeth there: that is, ceaseth from his further going or departure, and beginneth againe to come to the Equatoure. For the sun after his comming vnto that point departeth, and cometh againe to the equatour: so that the end, the departure, and beginning of his comming, is the solstice. Therefore not for that the sun stayeth there, are they called the solstices, although about those pointes of the going and comming of the sun, it is so small, that for foure, five, or moze daies after, he seemeth in iudgement as it were to stay in one declination: and therefore for that cause may be named the solstitials. These of sundrie (as of Campanus) are also called Tropicke points, through the suns returning. And these may be called Verticall or Cardinal cycles (seeing they goe by those tops of the world) and expresse or shewe the foure quarters of the Zodiacke. Moreover seeing certaine parts of these cycles being neare the pole are hid, and the other right against them nothing at all discerned at any time: therefore is it that they are called in Greeke *Kolonoi*, which is in English, maimed and vnperfect, as Proclus, Diadochus, Mocrubius and Capella, write. But this agreeth not in the right Horizont, seeing there is no part of heauen, which doeth alwaies remaine there hid. But in the description of the astrolobie, howe large soener the same bee, yet onely these cycles appeare continually vnperfect.

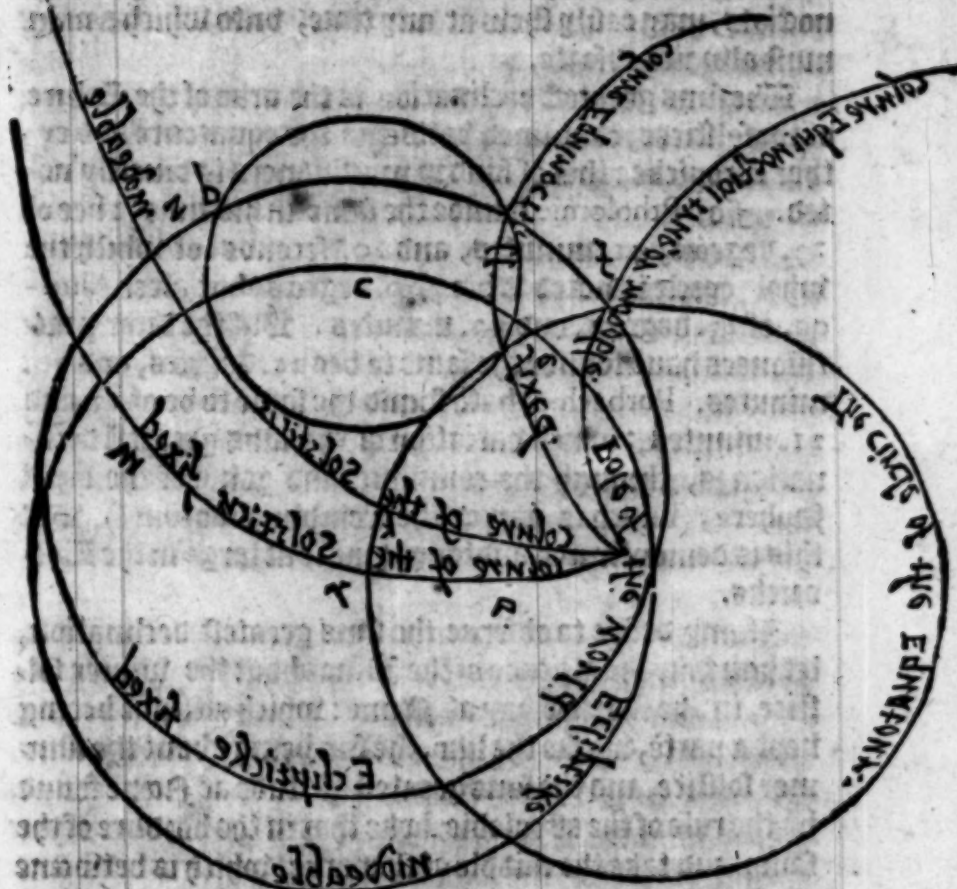
Yet further, the Colure of the solstices, or the cycle distinguishing the solstices, which also is called the solstitiall cycle, is a greater cycle drawne and passing by the poles

of the world, and Zodiacke, and the greatest declinations of the same: and by the beginnings of Cancer and Capricornus. It is called the Colure of the solstices, in that it passeth by the solstitiall pointes (as by the beginnings of Cancer and Capricornus) which are named the solstitiall pointes; for that in them the solstice is caused: that is, the suns coming vnto those pointes, departeth not further from the Equinotiall, but cometh againe vnto the Equinotiall, which is caused twice in the yeare, as in summer and winter: whereof the one is called the summer solstice (which in our time hapneth the 12. of June or thereabout) being the next day after S. Barnabe the Apostle, where the longest day is holden to be. The other the winter solstice, which in our time hapneth about the 11. or 12. day of December (being a day or two before Lucie) where the day is accounted shortest: whereof is this auncient verse extant.

Vnus est Lucia, dant tibi solstidia bina.

Of the former also ensueth, that there is certaine fixed and moueable Colures. For there is a fixed Colure of the equinotiale, which passeth by the poles of the world, and section of the equatoure and Ecclypticke of the first mouer. The fixed Colure of the solstices doth cut this at right angles in the poles of the world, and passeth by the middle of the suns greatest declination. Seeing neither the equinotials nor solstices, are caused according to the true meaning of the astronomers (as afore may appeare) both in these points, aswell as in others: Therefore a man must conceiue, that the Colures be moueable: of which the one goeth by the true equinotiall; that is, by the section of the suns way, and equatour, and by the Poles of the worlde, and the other of the solstices, passeth by the suns greatest declination. These hitherto written, may more plainer appeare, by this demonstration here following.

In



In this figure, are the cycles, and parts of the cycles noted with their names. In which the letter F. expresseth the true and moveable equinoctiall. The letter E. is a note of the fixed Equinoctiall. The letter D. pointeth out the head of Aries, of the eight sphere. The letter C. the center of the eight Sphere. The letter A. of the ninth and tenth sphere. The letters K. N. represent the suns greatest declination truely. The letters R. M. the suns middle declination greatest. How much the Equinoctials are distant
 In y. one

one from another, the former large instruction of the equinoxials, may easily shew at any time, vnto which a man must alwaies resort.

The suns greatest declination, is the arke of the Colure of the solstices, contained betwene the equatoure and either Tropicke: this of sundry practicioners is diuersly noted. For Ptholomie founde the same in his time to bee of 23. degrees, 51. minutes, and 20. seconds: of which the whole cyrcle is noted to bee 360. degrees, but after Almageon, of 23. degrees, and 33. minutes. But the later practicioners haue founde the same to bee 23. degrees, and 30. minutes. Purbachius hath found the same to be of 23. and 21. minutes: which variation of the suns greatest declination is, through the comming and going of the eight Sphere, (which is named the trembling motion.) But this is demonstrated and taught more at large in the Theopicks.

If any desire to obserue the suns greatest declination, let him take the altitude of the sunne about the winter solstice, in the shortest day at Rome: which altitude beeing kept a parte, worke the like, the sun being about the summer solstice, and the suns greatest altitude at Rome found by the rule of the astrolobie; looke that in the bordure of the same, and take the middle of that arke, which is betwene the suns least and greatest eleuation at Rome, which possesseth the myddle, and shall bee the suns greatest declination.

The knowledge of the suns declinations, with the other stars, is very profitable; in that by the same, and the perfection of the eleuation of the pole, the true place of the sun (if the same be unknowne) may bee knowne, the suns greatest declination presupposed, after this maner as followeth. Marke and consider diligently (the sun being in the Romestead cyrcle) caried vp from the Horizon: which founde, if the sun run in the Northerly signes, abate from
the

the saide elevation the complement of the elevation of the Pole. If the sun bee caried in the Southerly signes, then worke contrary; so; that which remaineth, shall bee the suns particular declination, As by a like example vse this. The sun being imagined to bee elevated aboue the Horizon 63. degrees, 21. minutes, and 4. seconds, the elevation of the Pole is 41. degrees, and 30. minutes, and the complement of the same altitude of the Pole to bee 48. degrees, and 30. minutes; with the which subtract the suns altitude at Pone, and the remainder shall be the suns declination, which is 14. degrees, 51. minutes, & 4. seconds, being the distance of the sun from the beginning of Aries, abated so; the suns running in the Southerly signes, at the time of the obseruation before the summer solstice.

What the offices or vtilities of the Colures are.



The common offices in generall of the Colures are, to shewe the four principall points of the zodiacke, in which through the suns motion the greatest changes and alterations of time is caused.

They serue to demonstrat the solstices and equinoctialles, and to deuide the Zodiacke into four equall partes, to which the four seasons of the yeare doe answere.

The vse of the one is to expresse and make manifest the pointes of the equinoctials, and the other to shewe the pointes of the solstices.

They both cut the Zodiacke and equatour, into two equall halfe Cycles, and both deuide either Cycle into four equall quarters.

It is.

5 But

5 But the Colure of the solstices offereth many other uses: for in the same is the sunnes greatest declination or thwartness measured and numbred, in that the sunnes greatest declination, is the Arke of the Colure of the solstices (inclosed betwene the beginning of Cancer and the Equatour) which arke is either increased or diminished, according to the winding in and out of the ecliptike vnto the Equatour, as is also mentioned.

6 They serue to distinguish the Equinoctiall, the Zodiacke, and all heauen into foure equall partes: the vse of which matter shall appeare in the place of the ascensions of the signes.

7 Each Colure besides, hath his private office or vntilities: as the Colure of the solstices, which hath foure offices. The first demonstrateth the solsticiall pointes. The second containeth and mesureth, the suns greatest declination. The third, that it stayeth by the poles of the Zodiack, and sheweth their distance from the poles of world. The fourth, that it deuideth the Zodiack into two halles, as into the ascending and descending. Also the same in the thwart Sphere, doeth seporate the signes rightly arising, from the signes thwartly rising.

8 The Colure of the equinoctials hath twoe offices. The first, that it demonstrateth the Equinoctiall pointes. The second, that it deuideth the Zodiacke into two halles; as into the Northerly and Southerly halfe.

9 To conclude, the Colure of the solstices doeth often supply and is vled in the stead of the Meridiane, when as in euery dayly reuolution of the first moner, it both twice enter into the place of the meridiane, or is twice ioyned in the plaine of the same.

The

The descriptions, names, and offices
of the Meridiane Circles, and
Horizont.



The foure greater cyrcles which we
haue already described, that with
the motion of the sphere are drawn
about, and euery where are alike,
which the other twoe Cyrcles are
contrary; as the meridiane and Ho-
rizont, that are not turned in the
drawing about of the Sphere, but
remain as immoueable and fixed;
neither are they alike in all places, but are continually
changed, standing or placed on the earth. In that all pla-
ces haue their proper meridians, and Horizonts.

For both by a mutuall touching and ioyning together
doe make right angles, and they continually deuide the
whole heauen into foure equall parts, and make the foure
angles and quarters of heauen, vnto which by a continu-
all turning aboute of heauen, both the one and the other
stars (as it were by an orderly succession drawne) worke
and send forth their vertues more effectuous, and exercise
their qualities in the Elements, then in any other places:
especially the sun being drawne vnto those bonds, for he
both beginneth and endeth the dayes and nightes, and di-
stinguisheth them equally, as it were in the middle par-
cels of time. The sun also come vnto the meridian, doeth
then more heat, dry vp and consume vapors.

The Meridiane of any place, is a greater cyrcle, which
goeth or reacheth by the poles of the worlde and height of
any place: and for that it passeth by the poles of the equa-
tour, Parallels, and the Horizont, through the same doth
it make right angles with them. And of this it deuideth

It fig.

all

all the arks of the Parallels as well in sight as not in sight into two equall halfes.

This circle hath sundry names, for Varro nameth it the Meridian or midday cyrle of the nonesteed, in that when the sun is in the meridia, or any other star aboue the earth, then hath it performed halfe the day arke, and is then at the bounde of the same time. But the other halfe of the night is caused, at the instant point of midnight, the halfe then reaching from East and West. So that of the same (this cyrle of all wyters in this science) named the meridiane, but of Ptholomie the cyrle of midday and middle heauen, by the same reason.

The astrologians call this cyrle the royall Cuspe, the regall quarter, the beginning of the tenth house, and the middle of heauen: in that this place is principall, and of worthier dignity then the other quarters, of which shall further be written in his proper place.

Further it behoueth by the addition (31. Primi Theodosij) that the Equatoure and Horizont, in the contrary manner, to passe by the poles of the meridian: & of the same that those poles is none otherwise placed, than in the common sections of the equatour and Horizont. By which sections, & by those poles of the Horizont, is a certaine thirde cyrle greater drawne, which Iohannes (a Regiomonte) nameth the verticall circle: so that by the foresaid Coplary or addition ensueth, that of these thre cyrcles of each Extre and Pole, are they in that common section of the other two cyrcles. Like as of the Equinoctiall, and two colures by right may be concluded. So that a triple denision is caused by the thre cyrcles, which appeareth on this wise: that as the meridian tendeth by our top and height from the South into the North; euen so by the same top it behoueth the other cyrle to be drawne and passe from the east into the west. that both cutting one the other at right angle, shoulde expresse the foure foresaide quarters of the world.

As

As the Horizont distinguisheth the vpper halfe sphere, from the neather, and the meridiāne from the East to the West; euen so it falleth out, that the thirde cyrcle, as that verticall, shoulde separte the Northerly from the Southerly halfe sphere. To these, while any standeth vpright toward the West, on such maner, that y^e middle of his body is in the common Center of thre cyrcles; then doth the Horizont deuide his vpper halfe from the neather, and the Meridiāne, the fore part from the hinder; and the verticall cyrcle the right part from the left. The thre common sections of these cyrcles, are their Cre-trees (as is afore written) doe indicate or shewe the foure principall points of heauen (which are the fire poles of the cyrcles) placed in the sections of the cyrcumferences, as the highest or lowest point (which are the poles of the Horizont) the point also most Easterly and Westerly, which are the Poles of the Meridiāne: to conclude, the pointe most Northerly and Southerly, which are the Poles of the verticall cyrcle.

Those people that seme to haue their sexe against ours (in respect of the roundnesse of the earth) that they dwell as it were vnder vs haue alike horizont agreeable to ours, alike meridian, and alike verticall cyrcle. But of these two, the halfe cyrcles which be extant to vs are hid or as it were vnder them. Contrariwise, those which be hid to vs, are to them extant. The pointe also highest to vs, is lowest to them: contrariwise the lowest to vs, is highest to them.



This

The figure afoze placed, both plainer expresse that afoze taught: where the letters A. B. C. D. represent the Meridiane, the letters B. E. D. F. the Horizon: the letters F. A. E. C. the vertical cyrcle: the letter G. the center of the cyrcles and worlde: the letters A. C. the Cre-træ of the Horizon, the letters B. D. the Cre-træ of the verticall cyrcle: the letters E. F. the Cre-træ of the Meridian,

To conclude, the point that to vs is most Easterly, is to them most Westerly, *et è contrario*. For the pointe most Northerly and Southerly, doe not change the surname, except you list to change or alter the names, like as of the Poles of the worlde. For that which is to vs apparant, is to them hid: and contrariwise to vs hidde, to them manifest.

Here may be demaunded whether that point of heauen most Northerly, be not the Northerly Pole of the worlde, and that point most Southerly, the Southerly Pole of the worlde. To which is thus answered, that if regard be had vnto the Equatoure and right Horizon, which passeth by the Poles of the worlde, and hath the equatour for the verticall, or in steede of the verticall cyrcle. But wee which haue not the Poles of the worlde in the Horizon (in whose cyrcumference these foure principall pointes of the East, West, North, and South, are accustomed to be noted) are forced to call that Northerly section of the Meridiane and Horizon, the most Northerly point, and that section right against the most Southerly point. For in euery place there are two sections which the meridiane and verticall cyrcle doe make with the Horizon, which are two right sections in the plaine of that Horizon (cutting at right angles one an other in the Center) that expresse and shew those foure quarters of the worlde, from which the principall windes blowe; as East, West, North, and South. So that the foresaid right sections doe part the Horizon, and cyrcumference of the same into foure quarters. The foure principall

fall windes (of the common sorte) are thus called, that which bloweth from the East, the Levant winde, and that right against it the Ponent: that from the North, Transmontanus, and that right against it the Mer dional. These foure of later yeares, they haue deuided into 32. windes, after the noted lines and pointes drawne in the Saylers carde, and other Happes euery where to be seene. Also the Saylers compasse doth expresse so many windes, directed by the adamant or lodestone, which haue the same doeth direct and shewe the windes, needeth not here be shewed, seeing the same is sufficiently known to euery sayler, which by the guide of their compasse, direct their course in cloy: by weather (either by day or night) in marking diligently the points of the compasse, how they coast.

To returne vnto the matter of the Meridiane: the diuersitie of Meridians is no otherwise caused, then the swelling of the earth, as in the first part I haue sufficiently writtē: the cause of which is, that one like parte of heauen cannot be the top or height of euery place. Therefore one meridian cannot serue all places, but that in all places a proper Meridiane is caused ouer the head. The meridian also is that which when the sun cometh vnto the highest ouer vs, sheweth by his working and heat the midday. This meridian is a greater cyrcle, passing by the poles of the world and Zenith, or a direct pointe ouer the head, abiding immoueable at the motion of the sphere.

This cyrcle is differing to euery Citty and people, by reason of the East and West, and is a proper meridian caused ouer the heade. For this is manifest, that at the chaunging of the verticall point, there is caused an other Meridian, through the swelling and roundnesse of the earth. Also a man may of one meridian line, describe many (as writeth Iohannes a regio monte) for in that instant of the Pōnetide, by letting downe right a plum line, the shadowe of the line causeth a newe Meridiane line on the plat

platfome. Therefore these with the verticall line in the the Center to the Horizon (crossing one an other at right angles) doe indicate the foure quarters of the worlde: as the meridian line, the North and South, the verticall line, the East and West.

The Horizon formeth the quarters of the east and west: of which the one is called the East rising, or easterly quarter or end: the other called the West setting, and quarter of the West.

The Peridiane defineth the boundes of the lowest and highest of heauen, and the quarters or middle motions of the day and night time: of which, that consisting the upper halfe Sphere, is named the highest place and middle of heauen, the other which containeth the lowest place right against it, called the bothom or lowest of heauen.

The Peridiane is a greater cyrcle, immoueable, not one and the same euery where, but to euery place peculiar and proper, drawne by the top of the place and Poles of the worlde (vnto which the sun carried by the motion of the first moouer) doeth in the day time cause high shone, and in the night time drawne right against it causeth mid night.

If this cyrcle were moueable like others, then at the motion of the sphere woulde it departe from our Zenith, and so lose the name of the Peridiane: neither woulde it deuide in proper place vnder it, the artificial day into two equall parts; seeing by that motion, the Peridiane should approach nether to one part of the Horizon, then to the other part. For should it stay the Horizon at right angles, of which it is numbred and accounted amongst the outwarde cyrcles of the sphere. The like affirmeth Proclus, writing that the Peridiane is none of those cyrcles which is noted and decked with starres. For the cyrcles of the sphere are distinguished by starres, whereby those cyrcles may more easily be knowne in heauen.

The

The meridians are changed by the continuall chaunging of place in the swelling or imboling of the earth (according to longitude.) For by going continually right forth toward the East and West, it doeth purchase newe Meridians: as by going thre miles forth, then is another point of heauen, differing from the first ouer a mans heade and gone further by foure minutes of a degree.

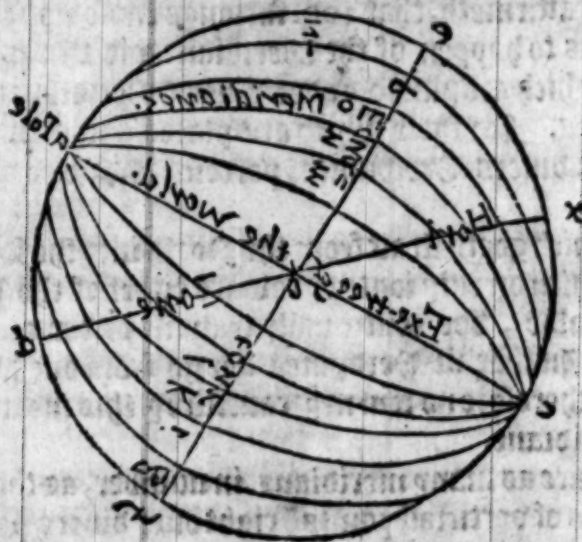
Proclus affirmeth, that 300. furlongs cause no sensible alterations to happen of the Meridian: and this is ment of those which are placed vnder diuers Meridians, and Parallels. For those which are placed vnder one Parallell and diuers Meridians, perceiue and see no alteration at all.

See which goeth strait from the North into the South, or they which directly iourney toward either of the Poles of the worlde, doe continually trauaile vnder one Meridiane. In that all Meridians doe go from one Pole to another, therefore no iourney canst by this meanes an other meridian.

There are as many meridians in number, as there be differences of verticall points (right ouer diuers parts of the earth) in going toward the East and West. The halfe of the equinoctiall hath 180. degrees, whereof the Cosmographers doe assigne and distinguish so many meridians, in such sorte, that each Meridiane doeth passe by the two opposite degrees of that Equinoctiall, and Poles of the worlde.

For a plainer vnderstanding of the former, conceiue this figure here vnder drawne, where the letters A. C. do represent the Cre-tre of the worlde, cutting the equatour and Horizon by the letter B. in the Center of the worlde; in that the plaine of the great cyrcles (when they cut one another) that section is made in the Centers. The letters E. B. F. is the equatoure, the letters X. D. the Horizon, the letter C. the antarticke or South Pole of the worlde, the
let-

letter A. the articke of North Pole of the cycle ending in the two pointes, the letters C. and A. are the Peridiane cycles, of these the outwarde is the meridiene fixed, as by example, passing by the fortunate Ilands, as after shal further be written in the proper place, from which the others begin, of which are commonly drawne 180. in the Cosmographick tables of spheres. The longitude of pla-



ces of cities is accounted: as for example, in the Equator, from the point E. Westward toward the point F. in that the Cosmographers accounted the longitudes at the equatour, & in it a degree maketh 700. furlongs on earth. That the Cosmographers begin to account the longitudes at the West, is for this reason; that the motions of the second monings (that is of the planets) are accounted properly from the West to the East.

The longitude of a place is the arcke of the equinoctiall cycle, or of any Parallell contained betwene two Peridians, of which the one lyeth over the fortunate Iles, and the other stretcheth over the top of the proper place noted, where

where the same distance of place is gathered from the fortunate Isles at the equinoctiall, or at the Parallell of the place. The fortunate Isles are situated and lying in the sea, called Oceanus Libicus beyond Mauritania (betwene the Equatoure and the tropicke of Cancer) which in our time is called the Isles of Canarie, and lie further into the North from the equatour, then Ptholomie noted or accounted them. But the latitude, they accounted to bee a space of the earth lying betwene either pole, accounted in the Meridiane drawne by the poles of the worlde, or a whole tract of the earth knowne and streached beyonde, and on this side the equatoure, toward either Pole of the worlde. They stablished the beginning of the latitude in the equinoctiall (as in the middle cyrcle equisitely betwene either pole) and common bound to both the Southerly and Northerly places,

So that the latitude of a place, is the arke of the meridian, betwene the equinoctiall and Parallell drawne by the top of the place: or it is the distance of a place from the equinoctiall. This alwaies is accounted in that meridian, which hangeth directly over the top of the place, and to one degree of the same, doe 500. furlongs, or 15. Germane miles answere.

The arks of the latitudes doe not differ from the elevations of the pole, but in the standing onely. For the elevation of the pole is the arke of the meridian, from the Horizont unto the Pole, rayled on high from the plaine of the Horizont. The latitude of a place, is the arke of the same meridian, placed betwene the equinoctiall and verticall point. To conclude, the latitude of a place, and elevation of the pole do not differ in the magnitude or largenes, but in standing onely.

By the former figure appeareth, that the Arke of the longitude of places or citties known, is forthwith offered at the first sight: as the arke E. P. or P. O. or O. N. &c.

And

And seeing the equatour (being in compasse about 360. degrees) doeth wholly ascend in 24. houres about the Horizont regularly: of this it cometh to passe (whiles in ech houre 15. degrees of the equatour doe ascend) that though the longitude of cities, it is easily knowne the houely distance of one place vnto an other, seeing the sun cometh later to the meridian to them which are nearer to the East then to them in the West, whereof if a citty shall be situated in L. and an other in K. the arke L. K. shall be of 30. degrees: then shall the sun come sooner vnto the Easterlier meridian K. by two houres, then vnto the Westerly. But if one citty shall bee in P. and the other in Z. then (in latitude onely) shall they differ, and shall be vnder one meridian; which is declared in the last part of the description of the meridian.

What the offices and vtilities of the

Meridiane are.



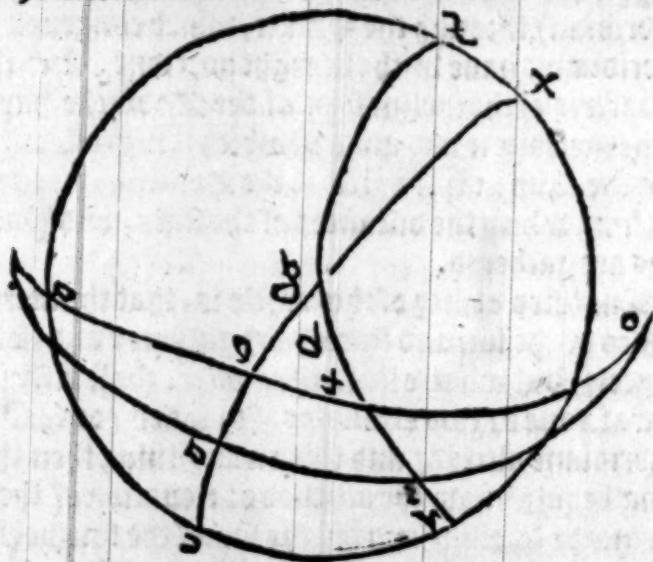
The vtilities and vles of this circle are many, of which the first is, that it distinguisheth the dayes and nightes into vnequal spaces: it determineth the forenone time or morning, and the after none or evening time of the artificiall day: the like of the night into houres (which are before night) and those which follow vnto morning. Many of the astronomers accompt their beginning of the naturall day from this cycle. It doth besides represent (without the equinotiall) the Horizont of the right sphere, and in euery habitude of the sphere it doeth represent the right Horizont, and sheweth the points of the midday, and mid night.

2 This

2 This cyrcle in the thwart sphere giueth and suplyeth the office of the right Horizont: for to euery thwart Horizont it leaueth or stayeth at right angles. So that the astronomer maketh or accompteth not his day, from the rising or setting of the sun through the thwartnesse of the Horizont, which causeth the variety & notable difference of the inclination of the Zodiacke, vnto the horizont of the angles, and largenesse of the rising. But they begin to accompt from none or midnight (the sun then occupying the Meridian) through the Sunne, which congruence all the meridianes haue with the right horizont. And that a lesser variety of the inclination of the Zodiacke hapneth vnto the meridiane and angles, which it maketh with the meridiane. Also in this cyrcle is the Zenith or direct point noted, from which the distances of the stars, and Parallel cyrcles are gathered.

3 The third vtility of this cyrcle is, that the meridian altitudes of the sun and starres are gathered and noted in this cyrcle, but what vtility they offer, shall sufficiently appeare in one or two examples. For when you shall haue the meridiane altitude and this in any time, then thereof you shall easily know the altitude or eleuation of the pole, if you minde to proue and try the same (the sun being vnder the meridiane of your place) take his altitude by some Instrument; as either by an astrolaby, or quadrant, which altitude found, you shall know the particular declination of the sun, by that aforetaught, which shall bee caused by the suns place, at the instant time known by y^e Ephemerides. For if the sun shall be in northerly signes, then abate the declination of the instant from the suns ascension Southerly: but if the sunne shall be in Southerly signes, then that declination shall be added to the ascension of the suns meridiane, and that which remaineth shall be the eleuation of the equatoure from the Horizont, or complement of the Latitude of the place, which is alwayes

like to the elevation of the pole. This complemente being abated from ninty degrees, you shall readily haue that which you seek; that is, the elevation of the pole. These by the figure here placed shall moze manifest appeare, in which F. R. C. is the thwart Horizont R. B. F. the middle part of the meridiene, passing by the Zenith of the place giuen or imagined, B. the verticall pointe or Zenith F. G. the elevation of the pole S. B. the latitude of the same place R. T. the meridian elevation of the sun which was sought,



C. G. X. the Colure of the solstices, E. D. the greatest declination of the sun, A. the beginning of Aries, T. the place of the sun, A. S. D. O. the halfe of the equatoure, A. T. O. the halfe of the Zodiacke (from the beginning of Aries vnto the end of Virgo) S. T. the suns particular declination of that instant time, and G. the northerly pole of the world. The meridiene beginneth and endeth the longitude of the earth, and particulare places on the earth, and both containeth and sheweth the differences of diuers longitudes. For the longitude of euery place from the meridiene (beginning at the fortunate Isles) endeth and resteth at the meridian streaching ouer the toppe of the same. Also it is

a space included within two meridians, of which the one resteth at the fortunate Isles, and the other over the top of the proper place.

4 In the meridians (as in the subiect) the distances of the stars from the equatour, the latitudes of places, and the elevations of the Pole are accompted. For the studious and skillfull practitioners, observe the latitudes of places and the elevations of the pole, not to differ in the quantity, but in the standing onely. For the elevation of the pole, is the arke of the meridian from the horizon, raised unto the pole. The latitude of the place, is the arke of the same meridian, contained between the equatour and verticall point: so that it is manifest that those arcs differing in the standing, doe agree in magnitude, whose verticall points, one meridian containeth, but not one Parallel, by an equall space from the west) be unequall distant from the equatour, and are then said to differ in the latitude onely. Contrariwise, to whose tops one and the same Parallel, and not one meridian, but each place proper; those by like spaces from the equatour, be distant by unlike spaces from the fortunate Isles, and are said to differ in the longitude onely. So that in both they are saide to differ; to whome the Parallel only serueth, and they to whome the proper meridian serueth: for they haue their spaces unequall to either bound. Therefore the difference of latitude is the arke of the meridian, contained between the Parallels of the two places, distant from the equatour. The quantity of the same is thus knowne; if from the halfe Equatour toward either pole of the places standing, the lesser latitude of the nearer, be abated from the greater latitude more further off: if from the halfe equatour the places be deuided vnder (that the one half leaneth into the North and the other into the South) by the latitudes of both ioyned, whether one or both by vnder one meridian or diuers meridians. For it forceth not in the meridian of both, that

the latitudes bee ioyned together, seeing all meridians are alike in the sphere.

The difference of the longitude, is the arke of the equinoctiall or Parallell, inclosed betwene the meridianes of the twoe places, distant from the fortunate Poles, and in themselves: by which the longitude of one place exceedeth the longitude of another. The same longitude is the arke of the equinoctial, seeing the places be vnder the equatour. For in the only longitude the places, the common Parallels, and tops of both bended, doe differ: in that the Parallels (from the equatour) toward the opposite quarters of the equall Parallels (as places to which they be right ouer) doe likewise differ. The meridians (as is afoze declared) are the greatest cycles of the sphere of the worlde, bended by the verticall points of all places, but drawn to the equatour (as by the Poles) of which they passe vnto right angles, and by a mutuall consent, make angles in the Poles of the worlde, which the arks of the equatour being placed betwene those meridianes, are measured, that by so much as a quarter of the cycle they bee distant from them: euen so the equatour from his Poles, is on either part distant by a quarter of the greatest cycle. Those arks doe containe the difference of longitude, by which one of the meridianes is further distant into the East then the other; so that the angles vnto the Poles betwene the meridianes, are rightly named the angles of the difference of longitude; and by the arks of the equatour, those also come into knowledge: for there is a mutuall relation betwene the angles and arkes each one of them towards another, which doe measure the angles. The latitude of places, is the distance of the verticall points from the equatour, gathered in the meridian. If then from the whole quarters of the meridians (which to the equatour and Pole of the worlde, toward which the places decline) the equall arkes bee stretched to the latitudes, then the scales of the places
given,

giuen, or the verticall points of them shall be found. And the other arks from these points vnto the Pole (which by a mutvall section doe make an angle) the complements of the latitudes, be known by the degrees abated from 90. in the degrees of the latitudes.

For a more plaine vnderstanding of the former, conceiue this demonstration here following: where the circumference of the meridian is described by the letters A.B. and by the Pole of the world B. is the circumference G.D. defined. To the verticall point A. or pole of the Horizont is the circumference of the Horizont E. F. drawn. Seeing that B. the pole of the equatour G. D. Therefore the arke B. D. a quarter of the greatest cyrcle, by which from D. G. the equatour B. the pole is distant. And as the letter A. is the verticall point, E. F. is the pole of the Horizont: euen so the arke A. E. shall bee a quarter of the greatest cyrcle: and the quarters of one cyrcle are D. B. and A. E. for that cause are they equall in themselves. If therefore the same common be abated from both: that is, the middle ark betwene A. B. which remaine, shall be the equall arks. And the arke A. D. is equall to the arke E. B. But the arke A. D. is from the verticall pointe vnto the equatour, which is called the latitude of the place. That E. B. is the arke

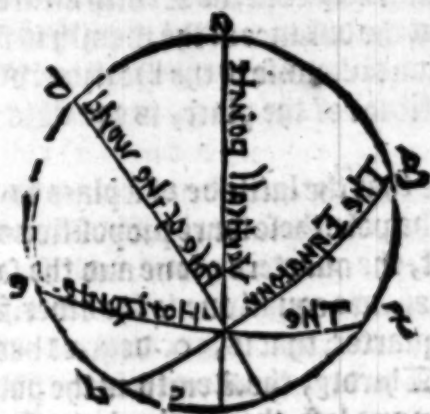


Fig.

from

from the Horizon vnto the pole, which is called the elevation of the Pole. Therefore to the latitude of the place is the elevation of the pole equall, as was afoze declared.

Further by the suns meridian had and found, you may easily conceive the elevation of the pole, and habitude of the sphere. For the whole quarter is, of 90. degrees. Seeing the suns meridian altitude in the equinotiall, must be subtracted from 90. degrees, the rest shew the elevation of the Pole. As for example, the suns meridian altitude of Viceberge in Germanie, in the time of the equinotiall, is of 38. degrees, and 10. minutes, the rest of the degrees of the quarter shall appeare to bee 51. degrees, and 50. minutes, which elevation of the pole neer agreeth to London. So that by so many degrees, is the Pole there elevated above the Horizon. And as the quadrant is from the pole vnto the equinotiall: euen so is the quadrant from the Zenith vnto the Horizon. If therefore in the time of the Equinotiall, the distance of the Horizon vnto the suns altitude be of 38. degrees, and 10. minutes; which is not the halfe part of the quarter, the same yet being subtracted from the whole quarter, doeth shew that the rest shall bee more then halfe part of the quarter: that is, 51. degrees, and 50. minutes. For those spaces which are from the pole vnto the Equinotiall, and from the Zenith vnto the Horizon, are alike: what the distance of the Zenith is from the equinotiall, the same likewise is the Horizon vnto the Pole; that is, the latitude of the place, is equall to the elevation of the pole.

To declare that the latitude of a place is equall to the elevation of the pole, these foure propositions are to be conceived. First, the quarters of one and the same cyrcle, any where taken, are equall one to the other. Secondly, the poles by the quarter; that is, 90. degrees bee distant from their cyrcle. Thirdly, the Zenith is the pole of the Horizon. Fourthly and last, the equals abated from the equals the

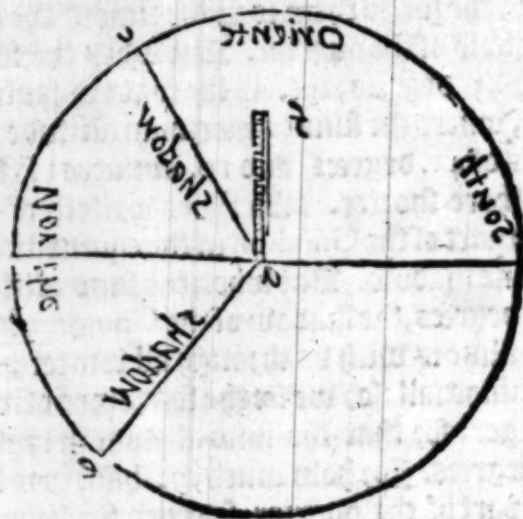
the equals still remaine. So that two quarters of the meridian taken (as that which is from the equinoctiall vnto the pole, and that which is from the Zenith vnto the Horizon) which seeing they are quarters of one and the same cyrcle, therefore are they likewise equall one to the other; that is, either containeth 90. degrees, when frō these two quarters the common arke is abated; which is betwene the Zenith and Pole of the worlde: and the rest of the equals remaine (as the arke which is from the equinoctiall vnto the Zenith) and called the latitude of the place; and the arke (which is from the Pole of the worlde vnto the Horizon) also called the elevation of the Pole, as may be vnderstanded of the former Viteberge, that is of 51. degrees, and 50. minutes.

Yet that you may easlier finde and knowe the elevation of the Pole of your City or Towne, you must first obtaine and haue the suns meridian altitude; which worke mainly may be had and obserued by the shadow. As when the suns altitude in the time of the equinoctiall is precisely of 45. degrees, the shadowe then is like to the Gnomone, which is at Venice (as Plinie writeth) also of Milaine and Lions: so the sun to them is in the time of the equinoctiall, in the middle of the quarter. But when the suns altitude exceedeth 45. degrees, then is the shadow caused lesser, as of Rome, where the sunnes meridian altitude in the equinoctiall is of 42. degrees, and 10. minutes: so that the shadowe is there shorter. Also Plinie writeth of Rome, that the ninth part of the Gnomon in the equinoctiall, doth lack of the noone shadow. But when the suns altitude is lesser then 45. degrees, the shadow of the Gnomon is caused longer. The like is with vs throught all winter and the time of the equinoctiall: so we see the shadowes of mens bodies to be longer, so that the suns altitude in that time is nearer 45. degrees. For how much the shadow is longer then the halfe part of the quarter, so much the lesser is the suns

altitude then 45. degrees. As of Viteberge in the 10. day of September, the suns meridian altitude is then of 39. degrees, and 21. minutes: but when the sun is further distant by the 45 degree of the quarter (or by the halfe of the quarter) then ensueth, that the shadow is so much longer then the Gnomon, or 45, degrees. For the same shadow in the 10. day of September is the like vnto the Gnomon, as the 50. degrees, and 39. minutes, are vnto 45. degrees.

Heere you see how by the meridian shadowe, you may finde the suns altitude; which obtained, you shall easily find the altitude or elevation of the Pole (especially in the time of the equinotiall.) For the suns altitude then from the whole quarter; that is, from 90. degrees, must be subtracted, and the elevation of the pole shall remaine and appeare to be, as is aboue taught.

Here by the way shall bee taught how to describe and find the meridian line, whose vse is great both for the Mathematician and Architect, in making of dials, and other necessary Instruments. To know and do this, haue a plaine body well polished and smothe, standing etuen on



every

euery side, that the one side bee no higher or more leaning then the other; in the Center of which, howe large so euer the cyrcle about be drawne, set vpright a stile, yron pin, or other Gnomon, as here the letters A. F. doe expresse; which pin must bee very straight, and not exceede the cyrcumference of the cyrcle, but his top to be equall to it: then shall it be alike distant round about, when it shall be alike distant from thre points at the least of the cyrcumference. But the height of the stile or Gnomon may not exceede a quarter of the diameter of the cyrcumference, and that for the same cause, that the meridiene shadowe (which of the shadowes is then most thort) falleth within the aboue said cyrcle described. In this cyrcle thus drawne and prepared, appeareth a shadow by the Gnomon of the suns shining in the forenone, untill it touch precisely the cyrcumference of the cyrcle, like as the shadowe A. C. demonstrateth; the point touched is noted and expresse by the point C. In the same maner is the afternone shadowe examined and found; whose point touched, is also noted by the point E. So that both the shadowes end within the cyrcumference, and at the bounds also of the shadowes, are the two pointes noted. The arke contained and included by the pointes C. E. betweene these, is deuided into twoe equall parts in the point D, by which and the Center of the cyrcle A. is the right line B. A. D. drawne, that shall bee the meridian line, which is as the common section of that Horizon and meridian. Thus is the way and rule of the meridian line described. For so Vitruuius writeth, and Iohannes a regio monte in his Capindarie, which as soone as that shadow of the Gnomon falleth on his line, it shall then be the point of none, wheresoeuer the sun at that time is placed. If another certaine line shal cut this by the Center of the cyrcle (lately described) at right angles. that shall bee the common verticall section of the cyrcle with the Horizon, which may be named the verticall line.

Seeing it is somewhat harde to finde the height of the Pole

Pole vnto any day prescribed, & that the same may moze easily and surer be attained and founde, you shall vse this table here following: by the helpe of which you may without great labour, finde and know the eleuation of the pole. For to procede and worke by this manner, seeke first the suns meridian altitude at the day offered, either by an Astrolaby or quadrant; but rather by the instrument named the quadrant, in whose bozdure are 90. degrees down or written, expresse by reason of the Gnomon and shadowe bpwarde. After seeke the degree of the Ecclyptike by the Epheemerides, which the sun obtaineth at none of the day offered: next by the table following, take the declination of the degree founde (by meane of the equinoctiall) if the sun then shall bee in Northerly signes, abate or subtract from the suns altitude afoze found: but if in Southerly signes, then adde vnto the suns altitude. The produce or rest is the eleuation of the equinoctiall, which abstracted or abated from the whole quarter; that is, from 90. degrees, leaueth & sheweth the eleuation of the pole, as in the 10. day of September, the suns altitude in the twelue houre (or at none) is of 39. degrees, and 21. minutes. To finde this eleuation of the pole, I enter the table following, where I finde and see the 27. degree of Virgo, to haue the declination of one degree, and 11. minutes: which degree and minutes (seeing they are in the Northerly part of the worlde) are to be subtracted fro the suns altitude that day, and the degrees which remaine are 38. and 10. minutes. The altitude of the equinoctial that day, which subtracted or abated from the whole quarter; that is, from 90. degrees, the eleuation of the pole which remaineth, is 51. degrees, and 50. minutes.

This

of the Circles.

155

This Table of the Suns declinations, containeth the number of the degrees of the Zodiacke, increasing in descending on the left hand, and increasing by ascending on the right hand, with the Signes decently placed : the Arks or roots of the declinations follow those numbers ; which rootes are no other then the arkcs of the circle of the Latitude : that is, the circle passing by the Poles of the Ecliptike, included betweene the Ecliptike and Equatour.

The generall Table of the Declinations.

23 30	Arket.	Arket.	Arket.	Arket.	Arket.	Arket.
G	Ar.	m	Ar.	m	Ar.	m
0	0	0	12	16	20	38
1	0	26	12	37	20	40
2	0	12			21	0
3	1	18	12	58	21	11
4	1	44			21	21
5	2	10	13	19	21	31
6	2	36	13	40	21	40
7	3	2	14	0	21	49
8	3	28	14	20	21	58
9	3	53	14	40	22	0
10	4	19	14	50	22	14
11	4	45	15	18	22	21
12	5	10	15	37	22	28
13	5	25	15	55	22	35
14	6	0	16	3	22	41
15	6	25	17	31	22	47
16	6	50	17	48	23	52
17	7	15	17	5	23	57
18	7	39	17	22	23	2
19	8	3	18	58	23	7
20	8	27	18	34	23	11
21	8	51	18	0	23	15
22	9	15	18	25	23	18
23	9	39	19	40	23	21
24	10	2	19	55	23	23
25	10	25	19	9	23	25
26	10	48	19	27	23	27
27	11	10	20	36	23	28
28	11	32	20	49	23	29
29	11	54	20	59	23	30
30	12	16	20	70	23	30
31	12	38	20	80	23	30
32	12	60	20	90	23	30

5



The meridianes with the Horizon, in any right or thwart, & in the other foure greater cyrcles, doe distinguish all heaven into twelue spaces, which they call the houses of heaven.

Of these foure, which occupy the angles of heaven, are called the quarters: the foure nexte to these, are named the succedents: the last (included by the succedentes and angles) are named the declining houses, and the cadent from the angles.

The meridian also hath a most great vse in Cosmographie: for by it the describers of the world measure the longitudes and latitudes of places and cities: which beeing knowne, the distance of cities may easily be found. That you may vnderstand what the longitude and latitude of a place is, it behoueth you to know the distinctiō of the earth after the Geographers, which is on this wise,

The Geographers doe assigne or imagine two points on the earth, right vnder the poles of the world: after that they deuise a cyrcle equally distant on either side frō these these two points (right vnder the equinotiall) which deuiddeth the whole Globe of the earth and water into twoe equall halves. This cyrcle thus described on earth, they distribute into 360. parts or degrees, in proceeding from the West into the East, by each degrees of this cyrcle; and by the points right vnder the poles, they imagine and draw 180. cyrcles; which, for that they are vnder the celestiall meridianes, they also call meridianes, and those they deuide into three hundred & threescore parts or degrees; by which parts they imagine and draw the Parallell or equidistant cyrcles to the equinotiall, proceeding from the equinotiall on either side, towarde the pointes in the poles lying

vnder

Under these Parallels, & although they bee not of the same bignesse or largenesse (so; how much nearer the poles they are, so much the narrower and strayer they run together. Contrariwise, how farre of they bee from the Poles, and nearer to the Equinoctiall, so much the wider and larger they runne) yet doe they deuide as the Equinoctiall, or any other greate cyrle, into thre hundredeth and thre score partes or degrees. Nowe this deuision of the earth being learned and vnderstande, a man may the more easily conceiue what the longitude and latitude of places is.

The longitude of a place (as I haue aforesaid written) is the arke of the equinoctiall cyrle, or Parallell, passing by the Zenith of the place which is sought after, included betwene the two meridians; as betwene the first meridian (which by the Zenith of the Isles of Canarie (and further off) is imagined to bee drawne, and the Meridian of the place offered: that is, the longitude of any place, is the distance thereof from that westerly point, from which the beginning of longitudes is accounted toward the East. They began to account the longitude from the west, through the proper motions of the Planets, which are caried vnto the contrary quarter from the West: or rather for the Pione, at whose Ecclipses it is well knowne that it more auaieth, then the true finding out the longitudes of places, or as some rather thinke likelier, that the places which ende and stand furthest Westward inhabited, haue bene surer and perfecter found. For through the nearnesse and opportunity of the iourneyes (which they in auncient time were mooued to trauaile and saile vnto) as the twoe Isles (named Gades) which lie by the furthest parts of Spaine beyond Granade, and since through the passage by West Ocean, men of later yeares haue sailed about the furthest partes without stop or impediment. But vnto the Eastward, they were stopped of their course by a great distance through the difficultie and perill of the iourney. And since
be

beyond the halfe circle almost threescore degrees, men haue sailed to Scythia besides Imaus (which now is named the great Tartaria) that reacheth bordering to the upper India, where the most large kingdome of Cathagia vnder the parallell of Thracia flourisheth, where Bebeid Cham was gouernour. And that is the part of Tartaria, which beginneth from the riuer Tanais, so that the largenesse of Scythia Asiatica (from the West to the East) doeth almost take vp 84. whole degrees. America in the sea Atlanticus, is of such greatnesse, that the same is supposed to be a fourth part of the world inhabited: the middle or halfe of it hath the longitude of 330. degrees, and the latitude of tenne degrees Southward. The sea Atlanticus hath many large Ilands in it; among which, the most notable are Spagnolla, Cuba, Parias (otherwise Cherisouesus) by the straight that reacheth vpwrd into the north. The middle of the same hath the longitude of 285. degrees: the latitude Northerly 44. degrees. For from 11. vnto 50. almost, it reacheth vnto. America stretcheth far into the South, beyond the tropick of Capricorne, although his bounde or furthest part Southerly bee not yet founde or knowne. To the auncient it was no further knowne Southward, then 17. degrees beyond the Equinotiall: and the furthest knowne to them Northerward, exceeded not threescore and three degrees, which (as Ptholomie witnesseth) was vnto the Iland Thylen. So that the whole latitude found by them, appeareth to be 80. degrees, both of the one and the other side of the equinotial: and on earth the same containeth 40. thousand furlongs, to which 50. hundred paces answer, but Germane miles two hundredeth thousand agree. Also the Iland Thilen or Thulen, standeth beyond Scotland, and the Iles Hebrides and Orchades, that be into the North and East, which is distant from the furthest bound of Scotland, but thre dayes sayling, if prosperous windes bee their helpe. At this day men haue found beyond Taylen (but somewhat
into

into the East (and most large bounds stretched and found beyond the articke or Northerly cyrcle, & these are whole without breaking of any sea betweene; and containe Suetia, Norway, Iseland, Grunland and Lapeland. The kingdom of Suetia appeareth most large, and containeth sundry nations and people; among which, they are of most account, the East and West Gutland people, inhabiting neare to Norway.


And vnder the King of Suetia are the Lapeland people, (as the Finelapons and Dikilapons) where are a wild and fierce people, dwelling almost vnder the pole articke (especially the Lapeland people) to whome the sun neuer setteth in the summer for 40. dayes space. Aboue these inhabit a people of a cubite long or high, hauing small and crooked bodies (named of some Pigmaliions) that liue vnder a very darke and bitter cold ayre or sky. And aboue Scania (neere to the West boundes of Suetia) doeth Norway stretch into the North, whose vttermoſt limit extendeth vnto the 71. degree almost of the Northerly latitude. Aboue this is the country named Iseland, by reason of the frozen waters and sea: where throughout the yeare it so bitterly freezeth, that throught the ycie seas there thicke frozen, it permitteth no ships to come vnto the, except in the three hottest months of the yeare. It aboundeth with brimstone, and burneth in many places throught the sulphure & brimstone veines. Plinie writeth, that the Ocean sea in the North is very large, which in these our dayes is well knowne. This also was learned of certaine skillfull sailers (which inhabited and very much had traualed this coast) that they knew not the limits or bounds of this sea toward the North, but supposed that this sea did compasse the whole earth. By this sea dwell many and mighty people; as the Danes, the Swedens, Norwaies, Gotelandes, Finelands, Russians, and Pruchenians: and vnder the pole artick the Laplands. The reason why in these places such force of moyſture aboundeth,

deth, is so; that a dayly and continuall cold of these places gathereth and thickeneth the ayre, and by a continual working resolueth into water. For when the ayre is not thoroughly purged by the suns beames, then the weaknes of them, and far distance of the sun from these places, must of necessity bee continually thicke and darke, which afterwards yeldeth and giueth plentifull floodes by deawes and raines. Albert mag. in his booke de natura loci, and 8. chapter, assigneth a witty and laudable reason, why the Northerly be inhabitable. The cause he setteth downe, in that sundry skillfull Mariners affirme (that haue many times sailed into the Northerly partes of the Ocean sea) that in those places is a continuall darknesse, which when men sawe they returned for feare, supposing (nay rather doubting) that none coulde saile any further in that quarter of the worlde, through the darknesse, and thicke mist, which hindreth the direction of their tourney. So that the nature of those places cannot bee sufficiently knowne to vs, seeing no man (as the learned report) hath attempted thither, through extremitie of colde their bearing sway. And so; that exceeding cold is a mortifying quality, therefore a man may coniecture, that few liuing creatures and beasts can there liue &c. Yet the part of the Northerly Ocean (vnto the Easterly side) is sufficiently knowne to many traualers.

Although the vttermoost boundes of the earth are not wholly knowne, yet the nearest approaching to them shall here bee applied, as the longitude of the earth distant betwene Peru (the Realme of America) and Cathaya, to expresse 315. degrees: or if any minde to accompt the longitude from the fortunate Isles, they may by a whole cycle containe them, euen as the whole Globe about in a maner both partly giue place to the water, and are partly dwellings for men, beasts, and other liuing creatures; although some places of the earth bee more inhabited then others.

But

But as touching the latitude; if toward the North in the country of Lapous, & the south (toward the vtmost coast of America shal end) being the vtmost distance of the earth hath very litle bene noted, of this shall small error be caused.

If two places offered or giuen be placed vnder the Equatour, of which the space is sought, then the arke of the difference of latitude, is the same with the arke of the distance, neither doth the verticall cyicle differ from the Equatour. For the equatour of either place doeth containe the verticall points, as may appeare in this tryangle, noted with A. B. C.  Which, if 15. german miles be brought into parts of the difference of longitude, and any scruples after remaine, denide those by 4. For (by so many minutes of a degree, doth a German mile answer) that the distance shall make. As Ptolome writeth, of the places vnder the Equatour.

The high lande or mountaine of the Satyres, in the country of Syna, whose longitude is of 175. degrees, and no minutes, nor hath any latitude. Myrica an yle of Ethiope vnder Aegipt, whose longitude is of 85. degrees, the angle of the difference of longitude betwene the meridians of these places, is straight or right, and containeth a whole quarter or 60. degrees. The like are these places standing vnder the equatour. Colipolis a citty of India beyond the riuer Ganges, which hath the longitude 194. degrees, and 10. minutes, & Essina the greafe Mart-towne of Aethiope vnder Aegipt, whose longitude is of 70. degrees, and 3. minutes. The angle of the difference of longitude (which the meridians of these compasse) is blunte, and containeth 94. degrees, and 17. minutes. Againe the same or the like meridians containe and make a sharpe angle of 43. degrees, as of the citty Nubarta of Ta-

probane, which at this day is Sumatra, and Colipolis of India beyond or above Ganges: for it is distant from the west 122. degrees, and 20. minutes, and this containeth 164. degrees, and 20. minutes.

If two places be given, the one standing under the Equatour, and the other distant toward any other quarter from it. The first, that the angle of the difference of longitude is straight to these here placed. In that if two places given the one shall be under the equatour, but the other distant from the same toward some quarter, then must the angle of the difference of longitude be considered. If the same shall be right, then shall the distance of either place be the quadrant of the greatest circle. As in this triangle A. B. C. where the letter A. representeth the Pole of the equatour and the places given, that the one be standing in the point B. under the equatour, and the arke A. B. be the quadrant: and that the other consisteth in the letter C. the angle then of the difference of longitude, being C. A. B. is right. By Regio a montano de triangulis appeareth, that C. B. the ark of the distance of places which reacheth out right, is a quarter of the greatest circle. Wherefore if the degrees be multiplied by 15. and the minutes divided by 4. the distance then shall be knowne. As for example, Nubarta of Taprobane hath the longitude 121. degrees, and 20. minutes, but no latitude: the city Pyse of the Tuscans in Italie, hath the longitude 31. degrees, and 20. minutes almost, the latitude of 42. degrees, and 11. minutes: then the angle of the difference of longitude is right, for the difference is 90. degrees, or a whole quadrant. These then multiplied by 15. do procreate or bring forth the distance to be of 1350. Germane miles.

Essina a Port-towne or principall city of Acthiopie under



der the government of Aegypt, hath the longitude of 70. degrees, and 3. minutes, but it hath no latitude. The Ile of Tyrus hath the longitude of 67. degrees, and no minutes the latitude of 33. degrees, and 20. minutes. The difference of longitude, betwene the one and the other, is of 3. degrees, and 3. minutes. The complement of the difference of longitude, is of 86. degrees, and 57. minutes, of the latitude of the place not standing vnder the equatour, the complement is 56. degrees, and 40. minutes.

The royall cittie Colopolis of Inde (about the riuer Ganges) hath the longitude of 164. degrees, and 20. minutes, but no latitude knowne. The longitude of Tyrus is of 67. degrees, and no minutes, the latitude hath 33 degrees, & 20. minutes. The difference of longitude greater then the quadrant, is of 97. degrees, and 20. minutes. The quadrant being abated, there remaineth 7. degrees, and 20. minutes. The complement of the latitude of Tyrus, is of 56. degrees, and 40. minutes. If of two places giuen, either standeth without the Equatoure toward some one of the opposite quarters; and the other vnder the equatoure: then is the reason of the standing considered, and the angle of the difference of longitude. For the one differeth either by like spaces from each bound, and is nearer to the Pole, the other to the Equatoure. The same appeareth by the compared latitudes, which like toppes of either place containe the same Parallel, the vnlike being distant, and the Parallell by a space seperated, toward each place, doe argue peculiar and proper tops. But the angle of the difference of longitude, either it is right, blunt, or sharpe. This of the placing and diuersitie of the angles, doeth much varie or alter the reason & methode of the searching of these.

If two places giuen haue equall arcs of the latitudes, and from the middle or halfe of the equatoure bee alike distant, and how much so euer the angle of the difference of

Longitude be, as here vnder the difference of longitude is in the first, of the example taught: yet are the arkcs of the latitudes agreeing and equally founde, so that in this example appeareth no difference, but in the only longitudes of the places offered. As for example.

The longitude of Danske is of 39. degrees, and two scruples or minutes: the latitude of the same hath 54. degrees, and 48. minutes. The longitude of Lubecke is of 28. degrees, and 20. scruples, the latitude hath 54. degrees, and 48. scruples. The difference of longitude consisteth, of 10. degrees, and 42. minutes. The halfe difference is, of 5. degrees, and 21. scruples. The distance on earth, betwene Danske and Lubecke, is of 92 Germane miles, and a halfe.

The great citie Alexandria vnder the Turke (after Ptolomie) hath the longitude of 122. degrees, the latitude of the same, is of 41. degrees. That famous Toletum or Toledo of Spaine, hath a longitude to the same, of 10. degrees, the latitude of the same is, of 41. degrees. The difference of longitude betwene the one and the other, is of 102. degrees. The halfe difference, hath 51. degrees. The complement of the equall latitudes of either, is of 49. degrees. The whole distance betwene both appeareth to containe 1077. Germane miles and a halfe.

If of two places giuen, the one bee further distant from the equatour then the other, and the greatnesse of the complements of either latitude differing (as that the arkcs of the latitudes be vnequall) so that the diversity of the angle included with the arkcs of the complements, shal varie the methode or reason of the search, for that the one giueth and soymeth a right angle, another a sharpe, another a blunt angle: yet to these, the angle of the difference of longitude is right. The example of two places differing alike (both in the longitude and latitude) here appeareth. The citie Tacola (which at this day is called Malchana or Magna) a place

place of much resort of Marchants. This from the West hath the longitude of 160. degrees, and 30. minutes, of latitude from the equatour, it is 4. degrees, and 15. scruples distant. The other city and place in the countrey of Pontus (named Trapezus) being a head city of Cappadocia and was the auncient seat of the Emperours. This hath the longitude of 70. degrees, and 30. minutes, and the latitude of the same is of 43. degrees, and 5. scruples. The difference of longitude betwene the one and the other, is of 90. degrees. The arke of distance betwene both places is of 87. degrees, and 6. minutes: to which 1306. & a halfe Germane miles answere.

If the vnequall arkcs of the latitudes, and angle of the difference of longitude be lesser then the right, it causeth a diuers reason of the search, by which the arke of the complement of the greater latitude doth varie three waies, as it is greater or lesser, and as with the arke by the second inquisition surely knowne, and beeing ioyned, forme either more or lesse a quarter of the cyrcle. Or thus, that the angle which the vnequall complements of the vnequall latitudes include, be sharpe; that is, and if the arkcs of the latitudes of either place be vnequall, and the difference of longitude bee lesser then the quadrant. As in this example more plainer appeareth, of those places beeing of sundry longitudes. That worthy city Trapezus of Cappadocia, whose longitude is of 70. degrees, and 30. minutes, the latitude 43. degrees, and 5. minutes. The longitude of that well knowne city of Rome, hath 39. degrees, and 8. scruples, the latitude 41. degrees, and 8. minutes. The difference of longitude, betwene the one and the other, is of 33. degrees, and 22. minutes. Another example not vnlike the former, and not much varying from the former: as the longitude of Ierusalem, which is of 66. degrees, and no minutes, the latitude, of 31. degrees, and 40. scruples. The longitude of Viterberge, being of 30. degrees, and 30.

minutes, the latitude 51. degrees, and 50. scruples. The difference betwene the one and the other of longitude is of 35. degrees, and 50. scruples.

If in places vnequally distant from the equatoure, the angle of the difference of longitude shall be blunt, by which the difference of longitude shall appeare greater than the quadrant. And thus, that the angle of the difference of longitude be blunt, seeing the places are further distant then a whole quarter, and thereby causeth a diuers reason and way of serch from the former, which semblably the diuers quantity of the complement of the greater latitude doeth thre manner of waies varie, as in the same arke (which perfectly knowne by the second) is either greater or lesser. The example of this appeareth of these two places: the noble city Antiochia in Syria, which was after caled Seleucia, hath the longitude of 106. degrees, and no minutes, the latitude is of 40. degrees, and 40. scruples. The other of Tolerun, whose longitude is of 7. degrees, and 4. scruples, the latitude hath 37. degrees, and 50. minutes. The difference of longitude is of 98. degrees, and 56. scruples, which deducted from the halfe cyrcle (or 180. degrees) the difference that remaineth vnto the halfe cyrcle, is of 81. degrees, and 4. minutes. The like example not much varying from the former of these two places: as the noble city of Portugale named Lysboue, whose longitude is of 4. degrees, and 18. scruples, the latitude hath 39. degrees, and 38. scruples. The other named Calcutre (although the latitude differeth) hath the longitude of 112. degrees, and no minutes, the latitude is of 5. degrees, and no minutes. The difference of longitude, containeth 107. degrees, and 42. scruples more then the quadrant. The same deducted from the halfe cyrcle, doth expresse the difference remaining vnto the halfe cyrcle to bee of 72. degrees, and 18. minutes. The complement of the greater latitude, is of 50. degrees, and 22. scruples. The complement of the
 lesser

lesser latitude, is of 85. degrees, and no scruples.

Another example of two places distant from the Equator, of which the one is distant from the middle of the Equator into the North, and the other into the South, as this example further instructeth; the one being the Ile of Thilen (which in Ptholomic time was the uttermost bond of the earth knowne Northward) that hath the longitude of 33. degrees, the latitude Northerly, of 63. degrees. The other called the Ile of S. Thomas, hath the longitude of 27 degrees, and 20. minutes, the latitude Southerly, of 16. degrees. The difference of longitude, is of 5. degrees, and 40. minutes. The complement of the latitude Northerly, is of 26. degrees.

A third example of the difference of other two places, as Bassa of Tzprobanc, which Ptholomic affirmeth to bee in longitude 126. degrees, and in latitude toward the South 6. degrees, and 30. scruples. The other named Stocholma, in the Realme of Suecia, hath the longitude of 42. degrees, and 38. scruples, and the latitude of 60. degrees, & 30. scruples. The complement of the latitude Bozeal, is 29. degrees, and 30. minutes.

The common way of measuring of places, with their spaces, by the rules of longitudes and latitudes.



Here before, I haue somewhat written of sundry habitable places on the earth, whose sundry points differ betwene the one and the other; either in the onely longitude, or in the onely latitude, or in the longitude and latitude both together. Those places which do differ in the onely longitude, be distant by equal

spaces

spaces

spaces from the equatoure, toward either of the Poles of the worlde: the verticall pointes of those places ended by the same Parallell ioyning next the same space betwene: yet each haue their owne proper meridians, being not distant by a like space from the Westerly bounde. The distance of these is alwaies gathered and noted in the same Parallell, which commonly belongeth to either place standing or hanging right ouer the tops of them.

Those places which doe differ in the onely latitude, are standing vnder the same meridian, but they haue diuers Parallels, and each proper; and those continually distant vnequally, either toward one pole from the middle of the Equatour (if either place declineth vnto one and the same quarter) or otherwise from the middle of the equatoure separated and distant into the contrary quarters, by equall or vnequall spaces. If that one of the places looke into the South, and the other into the North, the distance of these is alwaies accompted in the common meridian.

Those places which do differ both in the longitude and latitude together, or both decline toward one Pole of the worlde, or separated and distant from the midst of the equatoure toward the opposite Poles (as the one looking into the North, and the other into the South) or els by equal Parallels distant from the equatour; of which two onely are in the Sphere. If they bee reduced and applied vnto one great cyrcle (per 3. secundi Theodosij) or els bee vnder by vnequall Parallels, and by an vnequall space. The difference of the longitude of those (which either bee toward them, or toward the Poles equally distant) is alway gathered in the middle Parallell betwene either of the bonds by arithmetical proportion, as afoze taught. But in those places which haue equall Parallels, and equally distant vnto the opposite quarters, the difference of longitude is imagined & noted in either of the equall Parallels. Therefore the arke hath the distance of the places standing, by
the

the next space *by* alons ouerthwart by the pointes of those places, which with the arcs of the difference of either (both of the longitude and latitude) both *soyme* and make a sphericall tryangle right cornered, alwaies in the vpper face of the Globe. If that two meridianes meete and ende at the poles of the worlde, and beeing cut by the ouerthwart circumferencees of the Parallels, doe make with the included arcs of them right cornered tryangles, through the foure right lesser angles: but the angles beeing not right, the arcs of the distance of the places both deuide them into two right cornered tryangles. One of those tryangles is vsed in the comon account for the right cornered; because in places not farre distant from the equatoure, the angles contained betwene the mutuall sections of the meridianes and Parallels, doe not so much varie from the right angles: but in places far distant from the equatour, they varie very much. *Now* the rules for the diuers standing of places shall be taught in an easie and common maner.

If places doe differ in the onely
longitude.



In the searching and knowing of this, like as in the former, are the longitudes and latitudes of places given required; by which they being founde (seeing in the latitude there is no diuersity) the difference of longitude is onely to be considered, by deducting the lesser longitude out of the greater, and then how many miles by proportion of the Parallell, vnder which the places stand or lie to the equatoure, answere to one degree of the same. The same doth that rule (set forth in the fourme of a table here following) declare, beeing *by* alons

drawne and made vnto this vse by the learned; in which, the miles that answere to one degree of each Parallell, are there founde and noted vnto one degree of the distance of the Parallell from the equatour. If to the whole degrees of the distance of the Parallels doe minutes depend, then from the difference of the two next numbers to one degree, may the proportionall part be deducted or drawne: which from the number of the miles expressed vnto a whole degree is abated, that the Parallels succeeding, may by little & little be caused to stretch & appeare narrower. To be briefe, the miles with the scruples or quarters (if any bee adioyned) let them bee reduced into the whole arke of the difference of longitude, which then shall manifestly shewe and expresse, the measured space by the Germane miles.

Ptholomic when he had learned the longitudes and latitudes of certaine notable places, he could extract and gather by them the other vnknowne places, by the distances truly learned from traualers. For by the longitudes and latitudes knowne of two cyrcles, and the distance also of them from any third place, there is then offered and giuen to know, as well the longitude, as the latitude of the third place. Further, in any two places lying and being in the vpper face of the earth, are five notes commonly learned. The distance of them, conuerted into degrees: the latitude of the one, and the latitude of the other; the difference of longitudes: the angle vnder the circumferencial distance: and the meridians contained by the other. Of the which five, if three onely be knowne, it is certaine that the other two may easily come to knowledge by the practise and skil of the sphericall tryangles.

An example of these former words (as touching the difference of longitude of two places) the latitudes beeing alike. As the city Byzantium now called Constantinople, whose longitude is 55. degrees, and no minutes, the latitude hath 43. degrees, and 5. minutes. The other city Trapezus

pezus hath the longitude of 70. degrees, and 50. minutes, the latitude of 43. degrees, and 5. minutes. The difference of longitude is of 15. degrees, and 50. minutes to one degree of the common Parallell, and to each place, doe 10. Germane miles with $\frac{1}{2}$. answere 02 agree. These now brought into the difference of longitude, doe cause & make 174. Germane miles almost. The like example to the former, is Arbela of Assiria, which hath the longitude of 80. and no minutes, the latitude of 37. and 15. minutes. The other Athens, whose longitude is of 52. degrees, and 15. minutes, the latitude 37. degrees, and 15. minutes. The difference is of 27. degrees, and 45. minutes.

Other brieft examples.

	Lon.	Lat.
Areca in Comagena being a part of Syria.	70. 10.	37. 15.

Megara the country of Euclide.	52. 0.	37. 15.
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The difference is of 18. 10.

	Lon.	Lat.
Philippi a city in Thracia or country of Alexandria.	50. 45.	41. 50.

The royall city of Roome.	36. 20.	41. 50.
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The difference is of 14. 25. longitude.

Lipsia,	29. 58.	51. 24.	The difference of log. is 9. degr. & 42. min.
Antwarpe,	20. 16.	51. 28.	
Vratislauia,	34. 34.	51. 10.	The difference of log. is 6. degrees, & 4. min.
Erphordia,	28. 30.	51. 10.	

If places doe differ in the onely latitude, or that both be placed toward one pole, or either distant from the middle of the equatour, so that in the oncle latitude the places differ, when the longitudes be like, the standing of the places is

is to bee considered towarde either Pole, whether either place declineth toward one Pole, or that the one be Southerly, and the other Northerly. If they decline vnto one place and quarter, then deduct the lesser latitude, out of the more, and the difference of latitude shall appeare. If eyther be distant from the middle of the equatoure, the latitudes ioyned doe shew the difference. The degrees, of the difference wrought by 15. and the scruples deuided by 4. shall offer & giue the estimate distance in Germane miles. As in this example, the city of Noriberge hath 28. degrees, and 20. minutes of longitude, the latitude is of 49. degrees, and 24. minutes. The other is Mylayne, whose longitude is of 28. degrees, and 20. minutes, the latitude hath 45. degrees, and 6. minutes. The difference of latitude, is of 4. degrees, and 18. minutes: the space betwene, is 64. miles and a halfe. Like examples are these.

Trapezus, 70. 15.	43. 5.	} The difference of latit. is 5. degrees, & 45. min.
Antioch, 70. 15.	37. 20.	
Padua, 31. 50.	51. 0.	} The difference of latit. is 6. degrees, & 44. min.
Budissina, 31. 50.	44. 16.	

If two differ together in the longitude and latitude, and that either declineth towarde one Pole, then in either toward the places differing, as in the longitude and latitude are the differences of the spaces from either bounde of the latitude and longitude gathered. The halfe difference of the latitude added to the lesser altitude shall shew the Parallel in which the difference of longitude is accompted. With that Parallel by this rule are the miles gathered and knowne, which answers or agree to one degree. These founde, reduce into the whole difference of the longitude, and that which proceedeth (agreeably) of the same; that is, multiplied in it selfe, or arising of the multiplication keepe. After the degrees of the difference of longitude reduce into 15. and the minutes annexed (if any such be) distribute or diuide

Deuide by foure, that which ariseth of either working, reduce ioynthly one to the other, and adde to the number kept afore. For of the whole gathered may the square roote be attained, which sheweth the distance of places. As by a like example, the city of Wreberge hath the longitude of 30. degrees, and 30. minutes: the latitude of 51. degrees, and 50. minutes. The other being Ierusalem hath 66. degrees of longitude, and no minutes: the latitude is of 31. degrees, and 55. minutes. The difference of longitude is of 35. degrees, and 30. minutes: the difference of latitude is of 19. degrees, and 55. minutes. The middle Parallel in which the difference of longitude is accompted, doth differ 02 is distant from the equator 41. degrees, and 52. minutes: to one degree of the same doe 11. miles, and 10. scruples of a Germaine mile answere, which reduced into the difference of longitude, doe procreate 02 bring forth 396. Germaine miles: these wrought together make 156816. The degrees of the difference of latitude being wrought by 15. & the scruples deuided by foure, doe make 266. Germaine miles; which multiplied one in the other, do performe and make 89401. Either of these square numbers ioyned, and the roote extracted, the distance shall appeare to be 425. miles.

The finding of the distances of places

or citties, in a more easier maner.



That you may knowe howe by the longitudes and latitudes of twoe places 02 citties, the distance of them may be found: thus do, when two citties be offered (whose largenesse is to you unknowne) seek the longitude and latitude of both by the Cosmographie of Apian, 02 Ptolomies

In *Principles of Geography*; which being found, write downe the longitude of the one vnder the longitude of the other, and the latitude of the one vnder the latitude of the other (as the former examples shew) in such sort, that the degrees of the other, and likewise the minutes vnder the minutes. After seeke the difference, as well of the longitudes and latitudes, in this maner: Subtract the lesser longitude from the greater, the remainder is called the difference of the longitudes. After deduct the lesser latitude out of the more, and the difference of the latitudes shall remaine. By the differences of the longitudes and latitudes, shall the distance of cities giuen be gathered. But in that there is thre maner difference of places, as that there be certaine places which differ in the onely latitude; that is, vnder one meridiāe, and yet lie vnder diuers Parallels: and certaine that differ in the onely longitude; that is, vnder one Parallell: yet are diuers meridians: and certaine that do differ both in the longitude and latitude; that is, they lie vnder diuers meridians, and Parallels, thre rules also of the searching of distances, betwene two places, are taught of the Geographers.

The first rule.

When two cities hauing one longitude are offered (but hauing sundry latitudes) deduce the lesser out of the more: the rest of degrees, in that they be the degrees of the great cyrcle, multiply by 15. (for that 15. Germane miles answere to one degree of the great cyrcle) and then shall you haue the distance of the cities.

But if minutes depend to the degrees of difference, the deuide them by foure, the quotient adde to the fore number of the miles. For seeing one degree is 60. minutes do make 15. Germane miles; it ensueth, that foure minutes make

make one Germaine mile, &c.

An Example.

MAdeburge and Egra agree only in longitude; that is, they bee equally distant from the West or from the meridian, which is drawne or stretched by the fortunateyles. For the longitude of either towne is of 29. degrees, the latitude of Madeburge is of 52. and 20. minutes: the latitude of Egra is of 50. degrees, and 5. minutes: therefore is Egra more Southerly then Madeburge. The difference of the latitudes, is 2. degrees, & 15. minutes; that is, 33. Germaine miles, with a halfe & a quarter of a Germain mile.

Another.

The longitude of Trydent is of 30. degrees, and 30. minutes. The longitude of Vireberge is almost the same. The latitude of Trydent is of 45. degrees, & 14. minutes. The latitude of Vireberge is of 51. degrees, and 50. minutes. These now differ in the onely latitude, which difference of the latitude is of 6. degrees, and 36. minutes; that is, 99. Germaine miles. So much is the distance almost between Trydent and Vireberge.

Another.

The longitude of Thunisis of 36. degrees, and 50. minutes; the longitude of Salernoe in a manner the same. The latitude of Thunis is of 37. degrees, and 30. minutes. The latitude of Salerne is of 40. degrees, and 30. minutes. The

The difference of latitude is of 2. degrees, & no minutes, that is, 120. miles. And so much is the distance betwene Thunis and Salernē,

Another.

The City of Yorke, and the Towne of Barwicke, agree in longitude; for the longitude of either place, is of 17. degrees, and no minutes. But they differ in latitude, in that the latitude of Yorke is of 54. degrees, & no minutes, the latitude of Barwicke, is of 56. degrees, & 10. minutes. The difference of the latitude is of 2. degrees, and 10. minutes: that is, 210. English miles. So much in a manner is the distance, betwene the City of Yorke, and Barwicke.

Another.

The City of London and Northampton, in a manner is of like longitude. For the longitude of London is of 16. degrees, and 30. minutes approximated. But they differ in latitude, in that London hath the latitude of 51. degrees and 34. minutes, the latitude of Northampton is of 52. degrees, and 50. minutes. The difference of the latitude, is of 1. degree, and 16. minutes; that is, 76. English miles. So much in a manner is the distance betwene London and Northampton.

Another.

This example differeth both in the longitude and latitude somewhat. For the longitude of Colchester, is 18. degrees, and 30. minutes, the longitude of Oxeforde hath 15. degrees, and no minutes. The difference of longitude betwene the one and the other, is of 3. degrees, & 8. minutes, that is, 109. English miles. The latitude of Colchester hath 51. degrees, and 59. minutes. The difference

rence of latitude, is no degrees, and 16. minutes. So that 16. English miles, is the distance betwene the one and the other, after their standing Northward.

Another.

CYgnea and Ratisbone, agree in longitude, for either is of 29. degrees, and 51. minutes: but they differ in latitude, in that the latitude of Cygnea hath 50. degrees, and 46. minutes, the latitude of Ratisbone, of 48. degrees, and 56. minutes. The difference of latitude betwene the one and the other, is 1. degree, and 50. minutes, which make 27. and a halfe Germane miles.

The second rule.

BEfore the second rule be here taught, it behoueth that you know howe many Germane miles aunswere to each degree of the parallel (passing by the Zenith of Cities offered.) Here conceive that not as in the former rule, to every degree of each parallel, but to each degrees onely of the parallel Cyrcle, which stretcheth and is vnder the Equinoctiall, and as principall of all the parallels, deuidenth the whole earth into twoe equall halues, to which are 15. Germane miles attributed, as to a degree of it. Where the other cyrcles (as afoze written) be not of the same bignesse, but how much nearer they be to the poles, so much the lesser they are: and how further of they be fro the poles, so much the greater they are. Whereof it is manifeste miles aswell the greater as the lesse Cyrcle of the parallels, is attributed or deuided into 360. degrees, and that those degrees (according to the distance of those parallels from the poles) be greater or lesser.

For the same cause shall you here finde in the table following, how many Germane miles aunswere in each euations, to the degrees of the parallels.

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A Table, containing the degrees of the differences of each Paralels, from the Equator vnto the proper Pole, by whole degrees of the Latitudes conuered into Myles.

Degrees.	Myles.	Scruples.	Degrees.	Myles.	Scruples.	Degrees.	Myles.	Scruples.	Degrees.	Myles.	Scruples.	Degrees.	Myles.	Scruples.
1	14	59	19	14	11	37	11	59	55	8	30	73	4	23
2	14	59	20	14	6	38	11	49	56	8	23	74	4	8
3	14	58	21	14	0	39	11	39	57	8	10	75	3	53
4	14	58	22	13	54	40	11	29	58	7	57	76	3	38
5	14	56	23	13	48	41	11	19	59	7	43	77	3	22
6	14	55	24	13	42	42	11	9	60	7	30	78	3	7
7	14	53	25	13	36	43	10	58	61	7	16	79	2	52
8	14	51	26	13	29	44	10	47	62	7	2	80	2	36
9	14	48	27	13	22	45	10	36	63	6	48	81	2	21
10	14	46	28	13	15	46	10	25	64	6	34	82	2	5
11	14	43	29	13	7	47	10	14	65	6	20	83	1	50
12	14		30	12	59	48	10	2	66	6	6	84	1	34
13			31	12	51	49	9	50	67	5	52	85	1	18
14	4	33	32	12	43	50	9	38	68	5	37	86	1	3
15	14	29	33	12	35	51	9	26	69	5	23	87	0	47
16	14	25	34	12	26	52	9	14	70	5	8	88	0	31
17	14	21	35	12	17	53	9	12	71	4	53	89	0	16
18	14	26	36	12	8	54	8	49	72	4	38	90	0	0

An Example for the vse of
this Table.



Vneburgum and Stetinum, haue the eleuation of the Pole precisely of 54. degrees, to knowe howe many Germaine miles aunswere to one degree of the Parallell, passing by the Zenith of either Citty, enter your Table, and there diligently looking, you shall finde by the degree of that latitude 54. noted eight miles, and 49. scruples of a mile. For so many miles in that Parallell aunswere to a degree; that is, eight, a halfe, and the third parte almost of a Germaine mile. And this is easily found, if the eleuation doth onely consist in whole degrees. For in each eleuation are certaine miles, and the scruples of a mile, answering to each degree assigned. But if the place or city haue minutes depending to the latitude as Viteberge whose latitude is of 51. degrees, and 50. minutes: then seeke in this table how many miles and scruples of a mile, are attributed to the whole degrees, and you shall finde by the degree of the latitude of 51. noted 9. miles and 26. scruples of a Germaine mile. After seeke the miles and minutes that nexte ioyned to the eleuation following, being 52. and you shall find right against 9. miles, and 14. scruples of a mile: which so set down or placed, y^e the miles bee vnder the miles, and the minutes vnder the minutes, after this maner.

	miles	minutes
	9.	26.
	9.	14.

Subtract the lesser number out of the more and vpper written, and there will remaine 12. minutes, of this rest; that is, of the 12. minutes, seeke the number proportional, according to the proportion of one degree or 60. minutes, vnto the minutes depending to the latitude offered, as of

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the latitude of Viteberge to the whole degrees, do 50. scruples depend. Of which so place the numbers by the Rule of three, working and saying on this wise, 12 $\frac{50}{10}$. that if one degree or 60. minutes of the degree 60 $\frac{50}{10}$. doe giue 28. minutes of a mile, how many scruples of a Germane mile, doe 12. minutes of a degree giue. To know this, multiply the first by the second, that is, 12. by 50. & the increase shalbe 600. this product diuide by the thirde number which is 60. and the part proportional shalbe 10. This proportional part found, subtract out of the miles, and minutes of the former elevation; that is, from the 9. miles, and 26. minutes: deduct the 10. and there will remaine 9. miles, and 16. scruples, precisely answering to one degree of the Parallell passing by Viteberge. Here the second rule followeth, which is easie to conceiue, if you worke according to the former taught.

The second Rule.

If two Citties be offered, which differ in the only longitude, first seeke by the instruction aboue taught, $\frac{1}{2}$ miles, and minutes of a mile answering to one degree of the Parallell, passing by the Zenith of those Citties. After, seeke the difference of longitudes in the degrees and minutes: then multiply the difference of longitudes, with $\frac{1}{2}$ miles and scruples of the miles, and the distance shall appeare of the Citties given.

An Example.

Viteberge and Westphalia agree in latitude: that is, they be both standing vnder one Parallell. For the latitude of Viteberge is 51. degrees, and 50. scruples, and exceedeth the latitude of Westphalia by certaine minutes, which here we passe, but they differ in longitude, in that Westphalia lies more to the West. The longitude of Viteberge is 30. degrees, and 30. scruples: the longitudes of Westphalia is 24. deg. & no min. To find the distance, see how many miles answer to one degree of longitude in $\frac{1}{2}$ parallel, passing by the Zenith of the Citties given. We

foze was taught, that in the Parallel of Vireberge 9. miles and 16. scruples do answere to one degree: wherefoze seek the difference of longitudes of the two Cities, and deduct the lesser number out of the more; that is, let the 24. degrees and no minutes bee deducted from the 30. degrees, & 30. scruples, & the difference resting, shall be of 6. degrees, and 30. scruples. Last, multiply the 6. miles and 16. scruples, with the difference of longitude; that is, with 6. degrees, and 30. minutes, and you shall haue the distance of the two Cities. But here obserue and note diligently in the multiplicatiō of the degrees, miles, and minutes, what proceedeth and commeth of the same. For the miles multiplied by the degrees, doe bring forth the miles: and the miles multiplied by the minutes of the degrees, doe bring forth the scruples of the miles. The minutes of the miles multiplied by the degrees, doe produce 02 bring forth the minutes of the miles. And last, the minutes of the miles multiplied by the minutes of the degrees, doe produce the seconds of the miles.

But that this may the readier be conceiued, vse this example, the former Westphalia and Vireberge: where the 9 miles and 16. scruples, are to bee multiplied by the 6. degrees, & 30. minutes on this wise. Multiply the 9. whole miles, by the 6. whole degrees, thus: as sixe time 6. bringeth out 54. miles. Multiply after that, the whole miles by the minutes of the degrees; thus, that 9. times 30. doe make 270. minutes of miles. After multiply the minutes of the miles by the whole degrees, and by the minutes of the degrees: as the 16. minutes of the miles multiplied by the 6. degrees, doe make 99. minutes of miles. After this the 16. minutes of the miles multiplied by 30. minutes of the degrees, doe make 480. seconds of miles; which minutes and seconds gather into whole miles, in this maner. First deuide the 480. seconds by 60. and the quotient shall be 8. minutes. (For that one minute containeth

neth 60. seconds, as one degree doth containe 60. minutes. These 8. minutes, adde to the minutes proceeded of the former or vpper working; that is, the 270. and the 96. & you shall haue 374. scruples of miles, which diuided by 60. the quotient will be 6. whole miles, and 14. scruples; that is, almost the fourth part of a Germane mile. These miles gathered of the seconds and minutes of the miles, adde to the 54. miles gathered afoze by the multiplication of the degrees and miles, and you shall haue the true distance betwene Viteberge and the Monasterie of Vestphalia; that is, 60. Germane miles, and almost a quarter.

This maner of working in searching the distance of places (which differ in the onely longitude) obserue in the other examples following: in which you shall finde their distance, by hauing their longitudes and latitudes.

Here folowing shall be sundrie examples, in which the young students and practisers may exercise them according to rule.

An Example.

Coleine and Marburge do differ in the onely longitude: for the longitude of Coleyne is of 23. degrees, and 28. scruples, the longitude of Margburge hath 25. degrees, and 45. minutes. The latitude of either (which agree) is of 51. degrees, and no minutes. The difference of longitudes is of 2. degrees, and 17. minutes. The miles answering to one degree (drawn in that Parallell by the Zenith of the Cities giuen) are 9. miles, and 26. scruples, as may appeare in the former table. But seeing no minutes depend to the latitude, the 9. miles, and 26. minutes are to bee multiplied by the difference of the longitudes: that is, the 2. degrees, and 17. minutes, in this manner: say-
ing

ing twice 9. doe make 18. miles, twice 29. are 52. minutes of miles, nine times 28. doe make 152. minutes of miles, and seauentene times 26. are 442. secondes of miles: which secondes and minutes deuided by 60. doe make three miles, 32. minutes and 22. seconds. These added vnto the 18. miles, declare the distance of Coleync and Margburge, to bee of 21. Germaine miles, and a halfe.

Another.

The longitude of Franckeforde is of 25. degrees, and 38. minutes. Hasforde is of longitude 37. degrees, and 52. scruples. The latitude of either, is of 50. degrees, and 12. minutes. Nowe they differ in the onely longitude, so; that the difference of the longitudes is, of 2. degrees, and 14. scruples; that is, Franckeforde by twoe degrees, and 14. minutes, is more towarde the West, than Hasforde. The miles according to latitude 50. are 9. and 38. minutes, and the miles according to the latitude following, as 51. are 9. and 26. minutes. The difference of these twoe manner of miles and minutes, is 12. minutes: the parte proportionall subtracted, is twoe. The miles answering to one degree, in the Parallell drawne by the Zenith of Franckeforde and Hasphorde, are 9. and 36. minutes. Nowe as aboue these miles and minutes (with the difference of the longitude) that is, twoe degrees, and foureteene minutes multiplied, you shal haue the distance in Germaine miles; that is, twenty and two, and almost a halfe.

Another.

The longitude of Gaynt (the native towne of Charles
P. iiii. the

the first Emperour) of 19. degrees, and 8. minutes. The longitude of Lipsia of 29. degrees, and 28. minutes. The latitude of either is of 51. degrees, and 24. minutes. The difference of longitudes is of 10. degrees, and 50. minutes. The miles according to the elevation 51. are 9. and 26. minutes: the miles ensuing the elevation assigned, are 9. and 14. minutes. The difference of these two manner of miles and minutes, is 12 minutes: the part proportional subtracted, is 4. minutes. The miles answering to one degree in the Parallell (to Gaunt or Lipsia) are 9. and 22. minutes. These miles and minutes multiplied with the difference of the longitudes, do offer and shew the distance between Gaunt and Lipsia; that is, 101. Germane miles, and almost a halfe.

Another.

The longitude of Straseborow is of 24. degrees, and 30. minutes, the longitude of Landunum of Bauier is of 30. degrees, and 25. minutes. The latitude of either is of 48. degrees, and 45. minutes. The difference of longitude, is 5. degrees, and 55. minutes, &c.

Another.

The longitude of Direpsa is of 130. degrees, and no minutes; the longitude of Danaba of 104. degrees, and no minutes neither. The latitude of either is of 45. degrees, and no minutes. The difference of longitude, is 26. degrees, and no minutes.

An easier working.

If this curiosity in observing minutes trouble you, you may then with lesser paine and error leave them, especially

cially in places beeing not far distant a sunder, where the minutes omitted doe little force or hinder, howe neare soeuer you finde the true distance. And by this meanes the second rule, is of no difficulty: for that euery painefull labo2 doth especially consist in the multiplying of the difference of longitudes, with the whole miles offered by the former Table, according to the degree of latitude, of the Cities giuen.

An Example.

AMsterdam and Brandenburge (which as vnto whole degrees appertaineth) agree in latitude: for the latitude of either place in whole degrees, is 52. degrees. But they differ in longitude, in that the longitude of Amsterdam is 21. degrees, and 4. minutes, the longitude of Brandenburge of 30. degrees, and 35. minutes. They differ in longitude 9. degrees; that is, Amsterdam is nearer to the West then Brandenburge by 9. degrees, as the former table teacheth in the Parallell of the latitude 52. which containeth 9. miles. Now by so many miles is Brandenburge distant from Amsterdam.

Another.

Nordlinga and Nicostadium, agree in latitude, for the eleuation of the Pole, or latitude of either is of 48. degrees. But they agree not in longitude, in that the longitude of Nordlinga is of 27. degrees, and 54. minutes, the longitude of Nicostadium of 29. degrees, & 32. minutes; so that they differ 2. degrees, which make 20. Germane miles, as may appeare by the former table, where 10. miles are assigned to the latitude 48. Now you shall vnderstand that the distance of Nordlinga and Nicostadium, is of 20. Germane miles almost.

An-

Another.

The longitude of the City of Venice is of 32. degrees, and 30. minutes, the longitude, of Spoleum is of 36. degrees, and 30. minutes. The latitude of either, is of 44. degrees. The difference of the longitude is of 4. degrees. And 10. miles doe answere to one degree in the Parallel of the latitude 44. The miles being multiplied by the difference of the longitudes; that is, by foure degrees, doe declare the distaunce of Venice and Spoleum, to bee of forty miles.

If of two places, the one being Southerly, and the other Northerly.



If of twoe places giuen, the one hath a latitude Southerly, and the other a latitude Southerly: seek the difference of either space of the longitude; after subtract the lesser longitude out of the greater (but of the latitude Southerly and Southerly) according to the latitudes ioyned of either place. In the second place the standing must bee considered, whether they be scituated vnder equall Paralleles, and both distant by a like space from the Equatoure, or else otherwise separated by vnequall Paralleles, and by an vnlike space. For if the Paralles of the places giuen shall bee equall, then must the difference of longitude be accounted in either alike: but if vnequall (and that both shall bee distant by an vnlike space) then the halfe of the greater latitude applied to the lesser latitude, shall demonstrate and shewe the

the Parallell apte and meete to this instruction: with the same Parallell are the degrees answering to each degree, declared by the former rule, and the other is taught & shewed, as in the precedent place is declared.

Merce a Region of Aethiopia vnder Aegypt, hath the longitude of 91. degrees, and 30. minutes, the latitude of 16. degrees Southerly.

The Ile of S. Thomas in the boordure of Africa hath the longitude of 27. degrees, and 20. minutes, the latitude Southerly is 16. degrees. The difference of longitude is 34. degrees, and 10. scruples. The difference of latitude which the conioyned latitudes do make) is of 32. degrees. And seeing both by an equall space bee distant toward the opposite poles from the equatour, it therefore foareth not, that the difference of longitude bee gathered in either Parallell Southerly or Southerly, in that they be equall. For to one degree of the Parallell (which is of 16. degrees, distant from the equatour) doe 14. miles, and 25. scruples, answere or agree: which reduced into the difference of longitude, doe bring forth 495. Germaine miles; which multiplied togihter, doe bring forth 241064. The difference of latitude wrought or multiplied by 15. doe bring forth 480. Germaine miles, which againe wrought togihter do cause 230400. And by either quadrant conioyned, the square roote drawne out of the same, doth then declare and shew the distance to be of 686. Germaine miles.

The Ile of Thylen hath the longitude of 33. degrees, the latitude is. of 63. degrees Southerly. The Ile of S. Thomas hath the longitude of 27. degrees, and 20. scruples, the latitude Southerly, of 16. degrees. The difference of longitude, hath 5. degrees, and 40. scruples, the difference of latitude, is of 79. degrees.

The halfe difference of the greater latitude, applied to the Southerly latitude, bringeth forth that the Parallell is distant from the equatoure 47. degrees, and 30.

scruples

scruples: in which the difference of longitude, must be accounted. And to one degree of it in the rule, doe 10. Germane miles, and 7. scruples answer; which wrought in, to the difference of longitude, do bring forth 57. German miles almost. Those multiplied, doe make the increase to be 3239. By the difference also of the latitude, those multiplied, doe bring forth 1404225. Of the quadrants ioyned, the roote hath 1189. Germane miles almost; that is, the distances sought of the places.

That the studious and diligent practisersoners may easer perceine and perfecter vnderstand these differences of the standing of places, let them often accustome theselues therein, that when the longitudes and latitudes of sundry places be offered, they then consider whether they differ in the onely longitude, or latitude only, or in both, and what the latitude is of either, and into which parte from the Equatour; and besides that, they learne to expresse the standing of them by proper lines drawn, and the places noted.

If the numbers of the latitudes be alike, and the numbers of the longitudes be unlike, then doe the places onely differ in the longitude. Wherefore by two meridians found and defined, lying crosse to them in one Parallell, imagine and set the place of the greater longitude in the point of the crossing further off, that the other in the nearer may be placed vnto the West. For the place alwaies (whose longitude is lesser then the other) is nearer founde to the West, and the other is further distant into the East. The arke also of the Parallell included betwene either meridian, both demonstrate the difference of longitude.

If the numbers of the longitudes shall be alike, and the numbers of the latitudes unlike, then is the diuersity of the places in the onely latitude. Wherefore two Parallels drawn crosse, of which the one being higher and the other lower and crossing them by one meridian, they doe set the place

place of the greater latitude in the vppermost point of the crossing, and the other in the lowest point.

If the latitudes be alike, as the one Southerly, and the other Northerly: then the middle arche of the Meridian being betwene, is equally crossed by the Parallels of the places drawne thwartly by the Arke of the Equatour, in such sort, that the Equatour is by an equall space distant from either.

If both the numbers of the longitudes and latitudes shall be vnequall, and either place distant into the North from the Equatour, therefore in both is there a diuersity. Therefore two Meridians being imagined, the one Orientall dextre, and the other Occidentall synistre, and that by so many Parallels drawne thwartly, which crosse the Meridians, the one Southerly, the other Northerly: and that the place whose greater longitude is touched in the lowest and furthest point, and the other to be noted right against; that is, in the vpper and nearest point. And thus contrariwise: If one place shall exceed the other, both in longitude and latitude, and be further standing in the higher pointe of the crossing, and thereby more farther distant, and the other noted to stand right against, and the seates also of the places vnequally touch, which declareth and containeth the highest distance of such places. In the same maner is the standing of places descending vnto diuers partes from the Equatour exprest; being obserued in such order, that if the places of either be alike distaunte from the Equatour, the Equatour then is exquisitely standing in the middle of both: but if the places happen to be vnequall, then is the Equatour by an vnequall distance, placed farther off.

A

A third rule.

If twoe Citties offered doe differ both in the longitude and latitude, seeke first the difference aswell of the longitude, as latitude. After halfe of the difference of latitudes adde vnto the lesser latitude, and with the produce enter the table which in the former examples hath bene taught and practised: searching there the miles and minutes answering properly to one degree. The miles and minutes found, multiply with the degrees of the difference of longitude, and the produce multiply in it selfe, and you shall obtaine and haue the first quadrate. Thirdly, multiply the difference of latitude by the 15. Germane miles, and this produce also multiply in it selfe, and you shall haue the second quadrate. Last, ioyne or adde together these two quadrate numbers (and of that produced or encreased) search out the quadrate roote. The quadrate or square roote, is the distance of Cities offered.

An Example of the
third rule.

Vuichegarda and Verona, do differ both in the longitude and latitude, in that the longitude of Vuichegarda is of 41. degrees, and 17. minutes, the latitude is of 52. degrees, and 4. minutes. The longitude of Verona hath 31. degrees, & 18. minutes, the latitude is of 44. degrees, and 49. minutes. The difference of the longitudes is of 9. degrees and 59. minutes. The difference of the latitudes is of 7. degrees and 15. minutes. The halfe of the difference of the latitudes, is 3. degrees, & 37. minutes, which halfe added to the lesser latitude; that is, to Verona, which is of 44. degrees, add 49. minutes, doeth then produce or bring forth 48. degrees, & 26. minutes. This produce or increase is

is named the middle latitude, in that it is distant by equal degrees and minutes from either latitude of Vuischegarda and Verona; that is, it excedeth the latitude of Verona by 3. degrees, and 37. minutes, and Verona doeth excede Vuischegarda by so many degrees, and minutes. With this product or middle latitude; that is, with 48. degrees, & 26. minutes. I enter the former table, and according to the instruction afoze taught in the second rule, I finde in the parallell which is drawne by the middle latitude, to answer to one degree right against 10. German miles, and 2. minutes. It was also taught in the second rule, y if minutes depended to the latitude, that those should be sought in the former table, and by the next elevation following, the proportionall part to be sought. As in this example. The latitude 52. are 9. miles, and 14. scruples noted, and in that 3. degrees, and 37. scruples depende to a middle latitude, I seeke in the table how many miles and scruples are noted next to the latitude following, 55. and there I finde 8. miles, and 36. scruples. The difference between the miles and scruples of the elevations of 52. and 55. is 1. degree, & 22. minutes. By the proportion of this difference, is the proportionall part gathered and founde, according to the maner afoze taught in the second rule.

Another example of this third rule for thy further instructing of Viteberge and Lipsia, which differ in the longitude and latitude: for the longitude of Viteberge is of 30. degrees, and 30. minutes, the latitude hath 51. degrees, and 50. minutes. The longitude of Lipsia is of 29. degrees, and 58. minutes, the latitude hath 51. degrees, and 24. minutes. The difference of the longitudes is of thirty twoe minutes, the difference of the latitudes is of twenty sixe minutes. The halfe of the difference of the latitudes is of thirtene minutes, which halfe added to the lesser latitude (as to Lipsia) which is of 51. degrees, and 24. minutes, doth produce 51. degrees, and 37. minutes.

The

The product is caled the middle latitude, in that by equal minuts it is distant from either latitude of Viteberge and Lipsia; that is, it exceedeth the latitude of Lipsia, 13. minutes, and by so many minuts is it exceeded of Viteberge. With this product or middle latitude; that is 51. degrees and 37. minutes, I enter the former Table, and by the Instruction afoze vttered in the second rule, I find in the Parallel which is drawne by the middle latitude, that 9. miles, and 19. scruples doe answere there to one degree. And in the second rule afoze is taught, that if minutes depende to the latitude, which is sought in the former Table, then by the next elevation must the part proportionall be sought. As in this example to the latitude, 51. degrees, are 9. miles and 26. scruples noted. And in that 37. minutes depend to the middle latitude, I therefore seeke in the table how many miles and scruples are assigned to the latitude next following; that is, 52. degrees: right against which I finde noted 9. miles, and 14. scruples. The difference betwene the miles and scruples of the elevations of 51. and 52. is of 12. minutes: so that by the proportion of this difference vnto the whole degree, or 60. minutes, is the proportionall parte drawne or gathered, according to the manner afoze taught in the second rule. As thus, that as 60. minutes yelde 12, euen so doe 37. giue 7. minutes, which is the parte proportionall. The same minutes subtracted from the miles and scruples assigned to the latitude 51. that is, from the 9. miles, and 26. scruples, there remaine 9. miles, and 19. scruples. And so many miles and scruples in the Parallel of the middle latitude doth answere vnto one degree. Which being founde and knowne, these nine miles and the scruples, with the differences of longitude, which is of thirty two minutes, I then multiply, and they shew and bring forth 298. minutes: which multiplied againe in it selfe, do bring forth the first quadrate to be 88804. minutes. And this is the first part

parte of the working of these. Nowe followeth the other part.

I multiply first the difference of latitude, as the 26. minutes by 15. Germane miles, and they bring forth 390. minutes, which multiplied againe in it selfe doe yelde 151200. minutes, as the second quadrant is. Now these two numbers quadrate added, doe bring forth and make 240904. minutes, of which the quadrate or square rote is of 494. minutes of miles. These for that they are the minutes of miles, ought to be deuided by 60. and then they bring forth 8. whole miles, and 14. scruples; that is, a fourth part almost of a Germane mile. So that somuch is the distance, betwene Viteberge and Lipsia.

Another.

The longitude of Buda is of 37. degrees, and 44. minutes, the latitude hath 47. degrees, and no minutes. The longitude of Aquilgranum is of 22. degrees, and 24. minutes, the latitude hath 51. degrees, and 6. minutes. The difference of the longitudes, is of 15. degrees, and 20. minutes. The difference of the latitudes is of 4. degrees, and 6. minutes. The halfe of the difference of the latitudes, is of 2. degrees, and 3. minutes. The middle latitude is of the degrees, and three minutes: here (in that 3. minutes doe onely depend to the middle latitude) are omitted, seeing the leauing of them bring or cause small error. Then must you take the miles assigned to the latitude 49. that are 9. miles, and 50. scruples, which with the difference of the longitude; that is, 15. degrees, and 20. minutes are to be multiplied, and they shall bring forth 150. miles, and 46. scruples: which miles containe as a quadrate; that is, one parte in it selfe with the minutes, that may bee multiplied and resolued also into minutes in the multiplication by 60. it shall then bring forth 9000. minutes.

Dj.

minutes.

minutes to these adde the 46. minutes, and the number then shall be of 9046. minutes. These minutes againe multiplied in it selfe doe bring forth and offer the first quadrate, that is 81830116. The difference of the latitude, as the 4. degrees, and 6. minutes, multiplied by 15. doth produce or bring forth 61. miles and 30. scruples: which as they may bee wrought and multiplied againe in themselves, they may bee resolved into minutes, and you shall have 3660. minutes. These further wrought in themselves doe bring forth and shew the second quadrate, which containeth 13395600. The two quadrate numbers also coniointed, doe make 95225716. minutes. The roote of this; that is, 9758. deuided by 60. declareth the space betwene Buda and Aquilgranum, to be 162. German miles and a halfe.

Another.

The longitude of Roome is of 36. degrees, and 20. minutes, the latitude hath 41. degrees, & 50. minutes. The longitude of Ierusalem hath 66. degrees, and no minutes, the latitude is of 31. degrees, and 40. minutes. The difference of the longitudes is of 29. degrees, and 40. minutes. The difference of the latitudes is of 10. degrees, and 10. minutes. The halfe of the difference of the latitudes, is of 5. degrees, and 5. minutes. The middle latitude, is of 36. degrees, and 45. minutes. The miles answering to one degree in the Parallel of the latitude next following, are 11. and 59. minutes. These subtracted from the miles and minutes of the former elevation, there doe 9. minutes remaine. These thus founde and knowne seek the proportional part to bee subtracted, in saying, if one degree or 60. minutes in this Parallel doe yeld 9. minutes of a German mile, howe many minutes of a mile doe 45. minutes yelde or make, which depende to the degrees.

græs of the middle latitude. To know this, multiply 45. by 9. and the product denide by 60. then will 9. minutes remaine in the quotient. The part proportionall must also bee subtracted, which deducted from the miles and minutes assigned to the latitude 36, as from the 12. miles, and 8. minutes, doe 12. miles, and 2. minutes remaine. By which appeareth, that so many miles and minutes, doe answere to one degree in the Parallell of the middle latitude. This now is as a preparation and entrance, vnto the second working.

To haue therefore the distance of the fore saide citties, multiply first the 12. miles, and minutes, with the difference of the longitudes 29. degrees, and 40. minutes, and they shall bring forth 356. Germaine miles, and 59. minutes, which 356. miles, that may bee wrought together with the minutes 59, are to be resolved into minutes, the same is performed, if they bee multiplied by 60. To the same product being 21369. adde the 59. minutes, and they make 21419. These minutes againe multiplied in themselves, do offer the first quadrate, that is, 458773561. Thus you haue the vnderstanding and knowledge of the working of the first place.

After this multiply the 10. degrees of the difference of the latitude by 15. and you shall readily haue the miles 150. to which adde the 10. minutes depending, 2 miles, and a halfe of a Germaine mile, and you shall haue in this second part of the working 152. miles, and a halfe or 30. scruples of a Germaine mile. Which miles, as they may with the minutes bee multiplied together in themselves, so are they to bee resolved by that 60. multiplied into minutes, which then bring forth 9120. to which adde the halfe or 30. miles, and you shall then haue the whole to be 9150. minutes: which againe multiplied in themselves doe make the later quadrate to be 83722500. Now vnto the last, conioyne these two quadrates, and the whole

D is. summe

Summe shall bee 542496061 . minutes. The roote of this nūber; that is, 23299 . seeing it representeth the minutes of miles, deuided by 50 . doth then shew the space which is betwēne Ierusalem and Roome, in Germane miles, to be 388 . with a third part almost of a mile.

Another.

The longitude of Hamburge is of 37 . degrees only, the latitude hath 45 . degrees, and 24 . minutes. The longitude of Magdeburge hath 29 . degrees, and 38 . minutes the latitude is of 52 . degrees, and 20 . minutes. The difference of the longitudes is of 2 . degrees, and 38 . minutes. The difference of the latitudes is of 2 . degrees, and 4 . minutes. The halfe of the difference of the latitudes, is one degree, and 2 . minutes. The middle latitude is of 53 . degrees, and 22 . minutes. The miles assigned to the eleuation 53 . are 9 . and 2 . minutes. The miles assigned to the degrees of the eleuation following, beeing 54 . are 8 . and 49 . minutes. The difference now of these two manner of miles and minutes, hath 13 . minutes. The proportionall parte subtracted is of 4 . minutes; which minutes, let foure be deducted out of the 9 . miles, and 2 . minutes assigned to the eleuation 53 . there will then remaine 8 . miles, and 58 . minutes. Therefore so many miles and minutes, doe answere to one degree in the Parallel of the middle latitude. These miles and minutes now found, multiplied with the difference of the longitudes, doe bring forth 23 . miles, and 36 . scruples. And these 23 . miles, wrought together with the minutes; that is, multiplied in it selfe, and that resolved into minutes, to the produete also add the minutes 36 . and the whole then shall appeare 1416 . minutes. This number againe wrought into it selfe, doth offer the first quadrate, which is 2005056 . minutes. After multiply the difference of the latitudes, by 15 . miles, and

and the increase shall be 31. miles. These miles againe resolved doe yeeld 02 giue 1860. minutes, which multiplied againe in themselues, doe offer the later quadzante, which containeth 3459600. minutes. The whole summe, that is, the numbers increased of these two quadzats, are 5464656. The roote of the minutes, which is of 2337. minutes, deuided by 60. doth declare the distance which is betwene Hamburge and Magdeburg, to bee 39. Germane miles almost.

An easier working. and lesse
curious.

This great labour perhaps after the kind, may feare some from the practise of these, and the rather in that this curious 02 diligent multiplication of the minutes, needeth not in all 02 at all times, especially if the space of the two cities doeth not containe many miles, 02 that the cities offered be but a litle space distant one from the other. So where the distance is great, as of Viteberge & Frankforde, Noriberge and Roome &c. The minutes then neglected, do cause great errour. But if the space be small betwene the cities giuen, without the accompt also of the minutes (so that seldome in the onely minutes, as are the neare places together, doe they onely differ) the distance then by the onely degrees & miles whole, cannot be found. But if any be minded not so curiously to search the distances of places, then let him 02 them omit the minutes depending aswell to the degrees of the longitudes and latitudes, as the miles, and according to the instruction of the third rule, the minutes beeing neglected 02 omitted, you shall then finde without any difficulty the distance of places giuen.

An Example.

The longitude of Franckeforde is of 25. degrees, the latitude is of 53. degrees. The longitude of Viteberge, is of 30. degrees, the latitude hath 51. degrees. The difference of the longitudes, is of 5. degrees. The difference of the latitudes, is 1. degree. The halfe of the difference of the latitudes in whole degrees is nothing, wherefore the middle latitude, is the like nothing. The miles assigned to the lesser latitude, as to the 51. degrees, are 9, multiply nowe these 9. miles with the difference of the longitudes, with 5. degrees, and the increase shall be 46. which multiplied in it selfe, doe offer the first quadrate; that is, 2025. After multiply the difference of the latitudes, that is, one degree with 15. miles. which 15 miles multiplied againe in it selfe, do produce 02 bring forth 225. which is the later quadrate. These two quadrates conioyne, and of the increase seek the root, which then declareth the distance betwene Franckforde and Viteberge, to bee of Germane miles about 74.

Another.

The longitude of Brunswecke is of 28. degrees, the latitude of 52. degrees. The longitude of Viteberge is 30. degrees, the latitude of 51. degrees. The difference of the longitudes, is of 2. degrees. The difference of the latitudes, is 1. degree. The miles assigned to the lesser latitude, are 9. The difference of the longitude multiplied by 9. miles, doe produce 18. miles, which multiplied againe in it selfe doe produce 324. that is the first quadrate. The difference of the latitude, being one degree both make & containe 15. miles, which also wrought againe in themselves doe offer the later quadrate, which containeth 225.

Nowe

Now of these two quadzates conioyned, the roote is of 23. which number is almost the distance of Viteberge, in germane miles, from Brunswicke.

Another.

The longitude of Danske hath 39. degrees, the latitude of 62. degrees. The longitude of Noriberge, hath 28. degrees, the latitude is of 49. degrees. The difference of the longitudes is of 11. degrees. The difference of the latitudes, is of 5. degrees. The middle latitude, is of 51. degrees. The miles answering to one degree in latitude, are 9. The difference of the longitudes, that is multiplied with the 9. doth yeld 99. miles, which againe multiplied in themselves, do produce the first quadzate which containeth 9801.

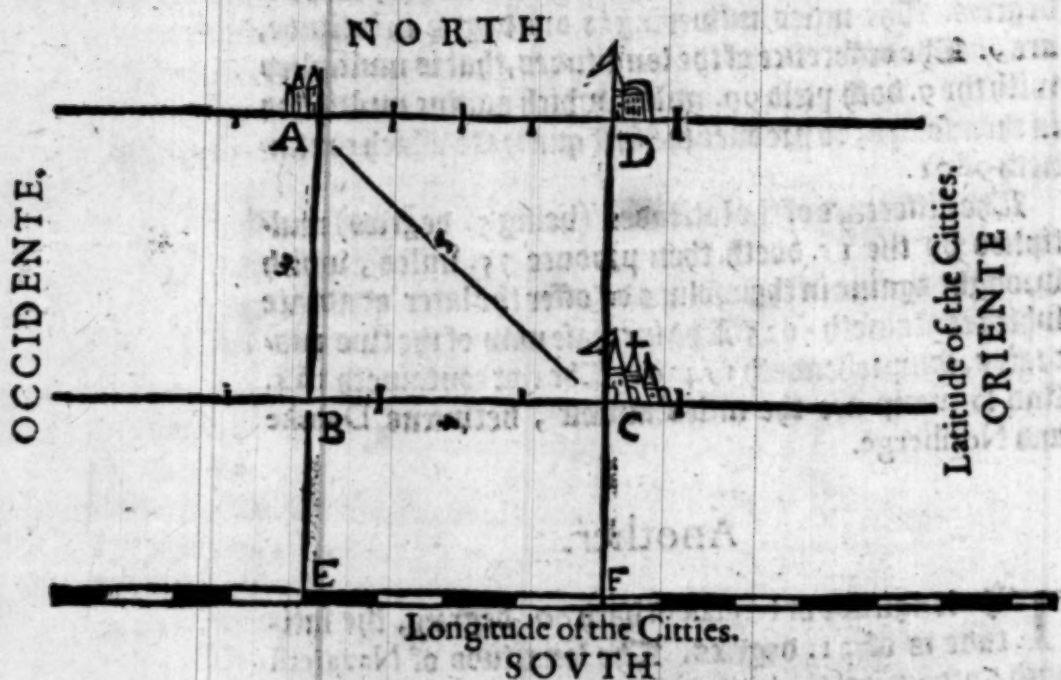
The difference of the latitudes (being 5. degrees) multiplied by the 15. doeth then produce 75. miles, which wrought againe in themselves do offer the later quadzate which containeth 5625. The increase now of the two quadzates, comprehendeth 15426. The root containeth 124. And so many are the miles almost, betwene Danske and Noriberge.

Another.

The longitude of Ierusalem hath 66. degrees, the latitude is of 31. degrees. The longitude of Nazareth hath 67. degrees, the latitude is of 32. degrees. The difference of the longitudes is 1. degree. The difference of the latitudes, is the like one degree. The miles assigned to 1. degree in the Parallel of the lesser latitude, are 12. The first quadzate doth containe 144. The miles answering to one degree of the difference of the latitude, are 15. The

later quadrate, comprehendeth 225. The increase of the quadrate, containeth 369. The root containeth 16. miles. Now the distance in a maner is so much, betweene Ierusalem and Nazareth. And thus by other examples, may young practitioners exercise, without labour, tediousnes, and paine, to finde the spaces of places giuen, by the degrees of the longitudes, and latitudes.

A demonstration of the
third rule.



The demonstration of this working or instruction, is taken out of the last proposition of the first book of Euclide, where hee doeth teach and demonstrate, that in the triangle right cornered, the quadrate which by the line or side drawne and stretching to, maketh a right angle, that is equall in the two squares, which are caused by the sides

containing the right angle. Which that you may easier conceaue and vnderstand, in the page going before is placed an apte figure to this matter, by which, a reason not onely of the third, but also of the rules of the first & second may be practised and declared.

Also there is repeated those thinges, which afoze were declared of the Theorickes of the longitudes and latitudes, that the yonger practisers may the readier and easier conceaue the rules hereafter taught. The line E. F. doeth represent the Equinoctiall on earth, lying vnder the celestial Equinoctiall cyrle. The line B. C. doth represent the Parallel; that is, the cyrle equidistant to the Equinoctiall cyrle, drawne ouer the head of Zenith of the city C. The line A. D. doth represent the Parallel, yea equidistant to that Equinoctiall, drawne by the Zenith of the cities, A. and D. The line A. B. E. doeth represent the meridian, of the proper city or place A. The line D. C. F. doth represent the meridian, of the cities C. and D.

The declaration of the first rule.

The two Cities C. and D. agree in longitude, in that they are vnder one meridian; that is, they bee distant by like spaces from the West. But they haue not alike latitude, so; that the City C. is nearer to the Equinoctiall than the City D. by three degrees. To haue therefore the distance, or that space betwene, you shall easily finde the same by the degrees of the meridian.

The declaration of the second rule.

The two Cities A. and D. agree in the latitude, or they haue one like elevation of the Pole, in that they are
vnder

under one Parallel, and the Zenith of both is by five degrees distant from the Equinoctiall. But the longitude of them is not alike; that is, they be not equally distant from the West: for the city A. is more Westerly then the city D. by foure degrees. So that the distance is to bee gathered and learned by those degrees betwene, in that Parallel.

The declaration of the
third rule.

The two Cities A. and C. be distant by unlike spaces, aswell from the Equinoctiall as from the Equinoctiall. For they be under diuers meridians and Parallels. The city A. is nearer to the West than the city C. by foure degrees, and it is further distant from the Equinoctiall than C. by three degrees. Wherefore by those degrees in which it is nearer to the West and furthest distant from the Equinoctiall, must the distance of the two cities A. and C. be sought. For that the space betwene the meridiene A. B. passing by the Zenith of the City A. and meridiene C. D. stretching by the Zenith of the city C. containeth foure degrees: yet those degrees are not in the great cyrcle, in that those two Parallels doe not deuide the earth into two iust halues, but into vnequall halues: so that of necessity it must follow, that the degrees of diuers Parallels haue vnequall spaces. Wherefore in the third rule are not the miles answering to the degrees of the lesser eleuation taken, except the difference of the latitudes bee small: nor the miles taken, answering to the degrees of the greater eleuation: but the miles are taken answering to the degrees of the middle latitude: for that it lacketh in one part, may be restored in the other. Of the same may the distance in miles be sought, according to the longitude. After this, in that the space betwene the Parallel A. C. passing by the Zenith of the city A. and the parallel B. C. reaching by the Zenith

nith of the city C. containeth three degrees, and these are the degrees of the meridian; that is, of the great Circle, where to one degree doe alwaies and euery where fiftene Germane miles answere. So that the distance of those Citties are easily found, according to their latitude.

And in the same by that multiplication of the miles and degrees, the adding of the product, by the increase and extraction of the root, that the distance of the Cities may necessarily and surely be gathered, is thus demonstrated. That in euery tryangle right cornered, the square which is made by the side, is drawne against a right angle, and is equall to the two squares which are made by the sides containing a right angle. As the quadrate which is made by the drawing of the line A. C. into it selfe, that is equall to the squares, which are caused by the drawing of the line A. B. into it selfe, and B. C. into it selfe: which by Arithmeticall practise may moze readier and better bee vnderstood of yong students and practicioners in this maner. First the side A. B. containeth three spaces, which multiplied, doe bring forth 9. The line B. C. comprehendeth 4. distances, which multiplied, doe produce 16. bringing forth 16. which two squares conioyned, doe make 25: & the square which proceedeth of the 5. multiplied (which the line A. C. containeth) doe they equate. Euen so in the instruction of finding the distances of places according to the third rule, the difference of the longitudes is represented by the line B. C. but the difference of the latitudes by the line A. B. Therefore as by the quantities knowne of the lines A. B. and B. C. is the quantitie of the line A. C. attained. Also by the differences of the longitudes and the latitudes of places knowne, and those afore taught being multiplied and increased, the distance of them is easily knowne, which by the line A. C. is represented. And in the Triangle and quadrate, is the side (but in the number) named the roote. These hitherto, for the knowledge of finding the distances of places shall suffice.

The

The definition, appellations, diuision,
and offices or vtilities of the
Horizont.

The Horizont called the ender and Cycle of the halfe Sphere, is the edge betwene the light part, that standeth for the same wee see, and the darke halfe that wee cannot see of the skie.

The Horizont (as Proclus writeth) is a greater cycle, immouea- ble or fixed, not one and the same e- uery where, but to each place proper from the verticall point, and round about equally distant, and deuiding the whole sphere of the world into two equall halfe spheres; of which, the one halfe appeareth in sight to vs, and the other halfe hid vnder the earth.

The description of the Horizont doth Macrobius teach; where he writeth, that the Horizont is after two conditi- ons: the one, extendeth on euery side vnto the firmament and serueth peculiarly as it were for the deuision of hea- uen, in deuiding iustly the skie into two halues: of which the one appeareth in sight to vs aboue the proper Horizont and the other hid vnder that Horizont from vs. Which Horizont hath his name of the skie, and of the same called the celestiall Horizont: whose diameter (after Macrobius) is as large as the diameter of the right sphere, which (as he affirmeth) is the furthest and highest parte of the skie, that men can readily see and discern with the eie. But the earthly Horizont, in that the same serueth for the sightes onely of the earth and water, and not stretching vnto the firmament; nor that his halfe diameter (as Macrobius writeth) doeth excede 180. furlongs, which containeth 22. miles,

miles, and $\frac{1}{2}$. So that the whole diameter after his account, is but 45. miles in length. Which if any man stand vpon an euen or plaine ground (or els on the sea) may see round about him 22. miles & a halfe euery waies. Which rounde compasse of the whole Horizont (after Macrobius) doth containe 141. miles, and $\frac{1}{2}$. parts.

A comparison, that as the meridian is an immoueable cyrcle, euen so is the Horizonte: for if the same were moueable, it woulde not crosse the meridian at right angles: and vnto these should be imagined, that if it were moueable, in each day the same would mooue with the meridian cyrcle.

The appellations and diuers names
of the Horizont.

This circle is called the Horizon, as it were the cyrcle deuiding the halfe spheres, or of the greek worde *Orizomai*, which in English signifieth to define, determine, and set out, in that the same defineth the parte of the worlde scene. Or of *Oros* or *Ori-*
on, that is the bound or ender.

2 It is named also the gyrdle, or the cyrcle of rising.

3 Macrobius calleth the Horizonte that bounde of heauen that is scene aboue the earth (lib. 1. cap. 15.) In that it is the end or bound seperating the neather halfe Sphere from the vpper. And of him also called the edge of the halfe sphere. And Alfragnus called it the cyrcle of the halfe sphere.

4 The Horizonte also is so defined of his office, in that his office is to deuide that part of the worlde in sight, from that hidde vnder the earth. Whereof it is not vnworthily

cal-

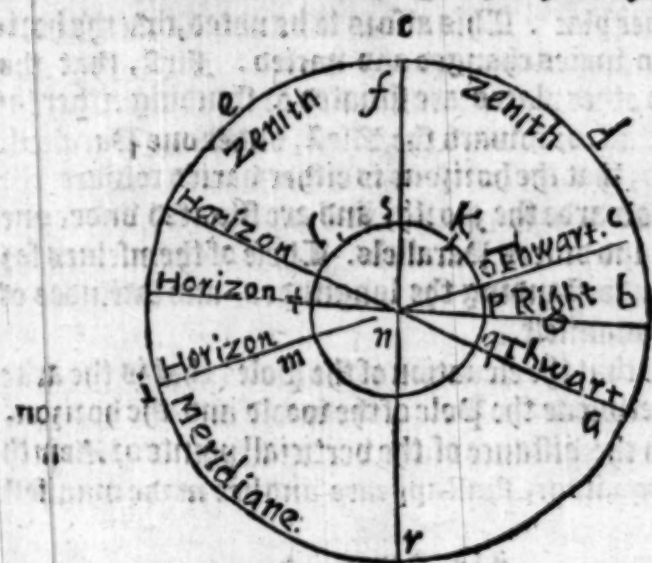
called the ender. seeing it permitteth not suffereth any to see but the halfe sphere at one time, and therefore is called of some, the cycle of the half sphere, as afore taught. This cycle is alwaies understood to be described by the verticall point, in that as the verticall point is changed, even so likewise is the Horizone.

The Horizone is deuided after twoe sortes; first into a right and thwart: secondly, into a sensible and rationall Horizone.

The Horizone of the right sphere is called right or right cornered, aboue which neither of the Poles of the worlde is eleuated, which they haue whose Zenith is vnder the Equinotiall, or dwell vnder the Equinotiall. Their Horizone is the cycle drawne by the Poles of the worlde, which deuideth aswell the meridian as the Equatoure at right angle, through which rightnesse it obtaineth that name, that it is called the right Horizone.

The thwart Horizone as of the thwart Sphere, from whose plaine the Poles of the worlde be distant, the one is then raised aboue the Horizone, and the other depressed and hid vnder the Horizone. So thus, the Horizone is called thwart or declined, when either of the Poles of the worlde is eleuated, which they haue which dwell without the Equinotiall, whether they dwell Northerly or Southerly. And their Horizone crosseth the Equinotiall at vneuen and thwart angles. And attaineth also the name of a thwart Horizone, through the thwart angles, which it formeth or maketh with the Equatoure. There is also one right Horizone, as there is one simple & right sphere, but the thwart Horizone is many waies changed toward the Poles of the worlde, through the standing and place chaunged on the earth. For the standing is so much the thwarter, as the sphere of the worlde is caused declining, & by how much either of the poles of the worlde, is drawne and raised higher. So that to it (by the obseruers of the
stars)

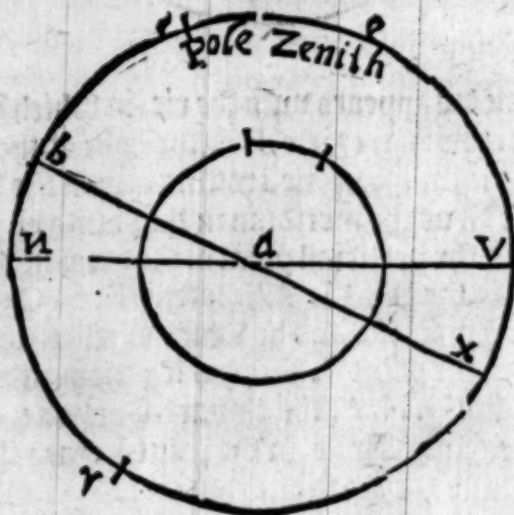
Stars) is the name giuen whereby it is called thwart. And note this that the zenith or point ouer the head, is alwaies the Pole of the Horizon: which Pole is here not taken for the celestiall point, vpon which the celestiall mouer or any other cyrcle is drawne, in that the Horizon is immouea- ble, as was afore taught: bu taken for the pointe raised, which is the Center of any cyrcle, as here by this figure



doe all the notes appeare vnto the eie, in which F. H. R. represent the meridian cyrcle, F. R. the halfe of the equatour H. N. B. the right Horizon, crossing alwell the Equatour in the point N. as the meridian in the points H. B. at right angles, F. is the verticall point of the dwelling vnder the Equatour, in the point S. The letters K. O. Q. doe represent the earthly Globe; and he which dwelleth without the Equatour in the point K. hath his top the pointe D. in the meridian, and G. N. A. the thwart Horizon, but dwelling in the earthly Globe, in the point L. hath the verticall point E. and the Horizon thwart I. N. C. But if any vnderstand or mean that L. K. Q. is the Dybe of the earth: whose

whose Center is N. and shall some six by the Horizonts or ends that that Dybe is deuided into two equall partes, as into that sene, and that not sene: and by the right Horizont H. B. the Equatour R. F. in the point N. at right angles, whereof it is called the right horizons to be deuided, and the others at thwart angles, whereof they are named thwart. Of this deuision hath been sufficiently intreated, in his proper place. This also is to be noted, that the horizons is two waies changed and varied. First, that the Cities and other places are situated or standing either toward the East, or toward the West, vnder one Parallell. The second, that the horizons is either varied toward the South or toward the North, and are situated vnder one meridian, and diuers Parallels. These of themselves for the right vnderstanding the longitudes and latitudes of places, are manifest.

Further that the eleuation of the Pole (that is the arke which is betwene the Pole of the world and the horizon, is equall to the distance of the verticall pointe or Zenith from the Equatour, shall appeare and bee made manifest



in

in this manner. As first that $EBVX$. is the meridian cycle BAX . the Equatoure, NV . the thwart horizons, the Pole of the worlde raised aboue the horizons, E . the Zenith, A . the Center of the worlde, R . the Pole antarticke so much depzsed, the arke RNC . the eleuation of the Pole from the horizons NV . giuen, EX . the latitude of the region or place being the distance of the top pointe E . from the Equatour BX . And that this is equall to the arke NO . as to the eleuation of the Pole C . from the horizon NV . giuen, which shall be demonstrated in this manner. That C . the Pole of the worlde, is distant from the equatour; BX . by a quarter of the meridian, and the like the verticall pointe E . is distant from NV . the horizons, by a quarter. But the quarters of the equall cycles are alike equall, so; XC . and NE be the quarters of the equal cycles: therefore in that they be alike equall, is CE . the common arke. I know by the common conceiuing and imagination of mind, that from the equals they bee equall, &c. then from either quarters XC . and NE . the common Arke CE . is to be deducted, & the remainder shall bee equall; that is, XE . which to that NC . ought to bee. And seeing the latitude of a place is no other, as by the former words appeareth, the distance of his Zenith from the equatoure, that readily hauing the eleuation of the Pole, the latitude or distance of the place from the Equatour shall soon be attained. By which the eleuation of the Equatoure aboue the Horizons in the meridian cycle, as the arke VX . is, sheweth no other then the complement of the latitude or eleuation of the pole is readily attained, if you deduct that complement out of 90 . deg.

The sensible Horizons is a space of the earth defined by a compasse rounde about, which the sight of the eie attayneth and comprehendeth in a plaine and euen field. And thus, the sensible Horizons is that which the eie perfectly seeth, and describeth according to the bounde of sight, and called of some the artificiall Horizons, and that for the same

cause, that which is contained by sight, is by a certaine similitude agreeing with the artificiall day. And as the artificiall day is so named, so that artificers doe especially worke in it, euen so the like is the horizone named artificiall, in that towers, fortresses, and castles in time past, were built like the horizone.

The diameter of this horizone (after Macrobius) which nearer agreeth to a truth (then either Proclus or Albertus) as afoze was taught, is of 36. furlongs, to which almost foure Germane miles answer, and 22. English miles: and so far on a plain and euen ground not hindered by hills or thicke mists, may a man fully see. And in the same space the imbossed rounds of the earth, being without hills, is increased, and groweth to 250. fete, or 125. cubits: so that this horizone is not sodainly changed, nor in a short space. Therefore of necessity must ensue, that those which are distant by a lesser space then 360. furlongs, to see alwaies some part of the earth common to both. But those which are distant by many spaces, doe comprehend diuers compasses by sight of the eie and diuers horizons.

The rationall horizone is that which afoze was described, that the same is a greater cyrcle, lying by the edge of the earth, and reaching round about vnto the skie, and diuiding the celestiaall Orbs into two equall halfe Spheres, as the one halfe in sight, and the other hid to vs. Although the plain vpper face of the horizone passeth not by the center of the earth, yet by the edge of the same, through which we see and obserue the celestiaall bodies, that rise aboue and set vnder it: so that they euidently shew, that the same diuideth heauen into two equall halfe spheres, as aboue remembered. For in euery moment, doe sixe signes of the Zodiacke appeare aboue the earth, as in the night to the eie may be numbred and noted, that sixe signes set vnder the earth, and be gone out of sight. This is also called rationall, seeing the eie cannot descerne vnto the highest heauen, nor aptly frame this diuision of heauen into two e-

quall halues : yet the mind by examining, gathereth and concludeth, as by a perseuerance passing befoze, and in the shewing of the starres that rise and set, and in considering the tarriances of them in either halfe sphere. This besides is called the artificiall horizone, in that by the benefite of the astronomicall art, it was inuented.

And thus not much agreeing to the former, the rationall horizone (which of some is named natural) and according to the mind of Ptholomie, Cleomedes, and Proclus, belongeth vnto the Sphere of the fixed stars, and reacheth euen vnto the same Sphere, and deuideth heauen into equall halfe Spheres, the one halfe appearing aboue the same circle, and the other halfe not appearing, hid vnder it. Such a maner of imaginig is not in vaine, nor without cause determined and deuised, seeing that men in the night and in a cleare season, standing on an euen ground, may see stars arise vnto sight in the East, which a litle befoze appeared not to the sight : and those after drawne by the first moouer vnto the West horizone, that began to go downe be set, and doe not after appeare. By which they concluded that there is a cyrcle in heauen, deuiding and ending matters in sight from those not seen. So that they nothing doubted to call this cyrcle the rationall horizon (which together with the vpper face by the center of the earth stretched round about vnto heauen) and by the foure quarters of the world, as East, West, North, and South, deuided things scene, from those not scene. And a great helpe it giueth vnto this imagination that the earth is perfect round and imbossed, in that of a Globe through his imbossing can be scene but the halfe at a time.

This also yeldeth a helpe to reason, by the appearances in the celestiaall bodie, although our sight cannot attaine vnto the starrie sky, nor fully descerne heauen, although a man earnestly looke vp and behold it : yet doe we see stars, whose light extend vnto our eie. As by this exam-

ple may evidently appeare, of that royall star named the heart of the Lion, which in our time is in the 22. degree almost of Leo. And the star standing on the left buttocke of Aquarius in the 22. degree almost of the same signe, that is diametrally or right against one the other situated. Which doe on this wise, that as the one appeareth about the horizon, the other is hidden vnder it, et c contra. So that as the one riseth, the other setteth, and on this manner doe they continually. Of which reason it is concluded, that a certaine cyrcle deuideth heauen into twoe equall halues, and do part (as afoze taught) the things sene, from those not sene. Although the variance be but small, in that this star appeareth a very smal while about the earth, though the same, that this star of Aquarius is southerly from the ecclipticke line, it greatly forceth not. The like examples may be applied of the superiour planets, when they be situated or appeare opposite in heauen, as they also may be evidently seen, in the opposition of the sun and moone, when they bee sene neare to the East and West horizon, and where the moone is neare the suns way.

The diameter of the rationall horizon, although the same cannot be found nor comprehended, through his exceeding distance by exteriour sence and iudgement: yet reason it selfe iudgeth, that the same may extend vnto the starry sky, whose sight from that not sene it doth describe and the same is of 32655932. Germane miles, and 20. minutes, which distance by the outward senses, is iudged as infinite.

The Pole of the rational horizon, is the verticall point. for it is distant by a quarter of the greatest cyrcle, that is, 90. degrees, from the compasse round about of the horizon, yet not to all places serueth one horizon, for that as a man changeth place and country, even so ariseth a newe horizon, whether so euer he trauaileth. And new horizons also appeare and happen, if a man either trauaile toward either

ther of the poles of the worlde, or in right line toward the East and West, and the like vnto diuers quarters, as into the North, the East, or West, or contrariwise iourneying by the opposite course, the Horizontes vary and change.

And if the places bee either situated partly toward the East or West, and partly toward the South or North, the horizontes there decline and varie them partly toward the East or West, and partly toward the South or North: which hapneth, by reason that the City is not vnder one Parallell.

And Cities or countries situated vnder one meridiāe doe vary their horizontes directly; either toward the South or North.

There be as many horizontes, as there be meridiāes. And so much as that of all places cannot bee one manner of Zenith, therefore cannot one Meridiāe serue so; all places. And seeing the Pole of the Horizonte is the Zenith of it, which is in the Meridiāe, and that to each place belongeth a proper Zenith, and a proper Meridian, it followeth that to each place belongeth a proper Horizonte.

Toward the Poles by the chaunging of places are the horizontes chaunged, and the diuers eleuations of the Pole by a certaine occasion caused: also they evidently declare a like alteration to bee caused in the respect of the opposite quarters of the East and West, and doe procure and cause diuers beginnings of the daies and nights, insomuch that the starres generally appearing and scene, doe by order of times and in sundry places, arise and set in the West and hide them vnder the Horizon. For the same maner of Eclipse, which is scene at Arbela (after Plinie) in the fiftte houre of the night, to them of Carthage it appeareth in the second houre: so that the sun sooner setteth to them of Arbela by thre houres, then to them of Carthage. Therefore

the horizon of Arbela is much further distant into the East then the horizon of Carthage.

The same rationall horizon (as it were on the plainesse of the earth) drawne and streached vnto the sky, doeth the meridian extend to it downward, and deuide the same into twoe halfe cyrcles: of which the one declineth vnto the East, and therof called the East quarter, and the other vnto the West, and of that named the West quarter.

And the diuers places of the suns rising and setting, doe sundry wise deuide either halfe cyrcle. For the Equinoctiall rising, and the Equinoctiall setting, (which are points of the horizon, that the sun in the equatoure placed, by rising and setting passeth) doe parte and deuide either halfe cyrcle into equall quarters. And with these points do the Poles of the meridian ioynne.

And either quarters do the other two (as the rising and setting) deuide into two vnequall arks. For of the twoe Northerly quarters, the same which tendeth and looketh vnto the East, is the solsticial rising, and the other the solsticiall setting. But of the twoe Southerly, the Easterly doth the winter rising deuide, and the Westerly doeth the winter setting part. But by what space these risings and settings may differ and be distant from the former middle in euery horizon, and in the largenesse of rising doth Ptholomie instruct in that elcuation of 40. degrees, and fiftene scruples.

Of the shadowes which the sun arising and setting in these points of the horizon causeth, is worthe to bee considered and noted, in that the Equinoctial shadowes (which thzough the sunnes rising and setting in the Equinoctiall pointes are caused) doe fall and extend in straight maner. But the other shadowes not in the same condicion or not in straight line doe fall, but that the solsticiall shadowes in the rising, with the winter shadowes in the setting, and contrariwise the winter shadowes in the rising, with the

sol.

Sollicitall in the setting doe fourme and make right shaddowes.

The offices or vtilities of
the Horizon.

This circle (like as al the others) so that nothing in heauen is frivolous and of a vaine imagination hath many vtilities. First it deuideth the whole heauen into two equall halfe spheres.

2 It declareth which starres be of continual appearance, and which continually hid vnder the horizon: which doe set, and which doe arise aboue the horizon. So that it appeareth, that the stars consist in a triple difference, as that certaine do arise and set, certaine neuer appeare aboue the horizon, and certaine continue and be alwaies aboue the horizon.

3 The horizon therefore is caused of the habitude, as well of the right, as the thwart sphere.

4 The rising and setting of the stars are applied vnto the horizon, by which settings and risings, the descriptions of times are chaunged, and it also declareth the degree of the Zodiacke, with the which each starre riseth and setteth.

5 The horizon sheweth the rising and setting of the signes of the Zodiacke, the exaltations, or elevations of the pole and the equatoure, the latitudes of places, to the largenesse of rising, which is the arke of the horizon to the stars or points of the eclipticke and equatour, arising together, included with the beginnings of the twelue houses of heauen.

6 By the office of the horizon, at any time wee may
P iij. learne

learne and knowe the quantitie of the artificiall day and night: and likewise procureth or sheweth the iust cause of the inequalitye of the artificiall daies, it doeth also declare the rising and setting of the sun. For as the horizons, according to the eleuation or depression of the pole, are varied: euen so are the verticall daies in themselves caused vnequall, yea in those points of the Zodiacke.

7 By the benefit of the horizon (the sun shining) we attaine and come each day vnto the knowledge of the vnequall houre of the day.

8 It sheweth to vs the elongation of the stars from the rising and setting, which the astronomers call the largenesse of the rising and setting, or the Zenith of the rising and setting.

9 By this cyrcle we learne how much the rising aswell of the stars, as the other points of heauen, is distant from the true and the Equinoctiall rising: that is, in the same are the latitudes of the stars accompted from the equinoctiall, and also their risings and settings.

10 It manifesteth the degree of the Zodiack, with the which the purposed star riseth and setteth.

11 It iudicateth the stars, or the celestial images that be continually in sight, or alwaies hid.

12 It maketh manifest the risings and settings of the signes of the Zodiacke. It doth likewise make distinction, betwene the Sun and Moones Ecclipses, sene as well above the horizon, as not in sight.

13 It helpeth and furthereth much vnto the finding of the latitude of a purposed place, whereof (thzough the benefit of this cyrcle and the meridian) may the distaunces of places be certainly found.

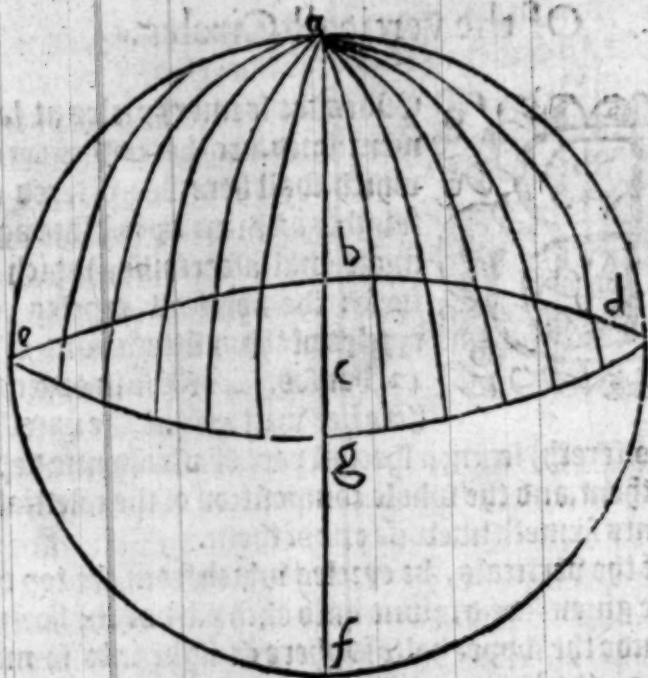
Of the verticall Circles.



Besides the former cycles at large mentioned, are there other cycles which shall here bee uttered and taught, as in an apte place agreeing to that aforesaide, which bee these: the verticall cycles; the cycles of the positions, and of the 12. houses. Of these in order shall here bee written (as the necessary matter offereth) seeing a speciall part of astronomie dependeth of them, and the whole composition of the celestial instruments seemeth likewise one of them.

First the verticals, be cycles which from the top of any place given, are drawne vnto each part of the horizon, and deuide the vpper halfe Sphere in sight into so many partes, as the Horizon is deuided; and all concurre and meete aboue in each verticall pointe or Pole of the Horizon. To the number of these, is the meridian adioyned. These cycles, are likewise vnderstande and noted immovable, as the meridian and Horizon; that is, they are not drawne about with the first mouer, as the Zodiacke, the Equatoure, the Colures, and the other cycles infixed to the first mouer.

But for a more euident declaration of the former wordes, vse this Figure here described: whereas a e g d. represent the Meridiane; e d b g. the thwart Horizon; a f. the Poles of the same. And from the verticall point or pole of the horizon, vnto e g d. the halfe of the horizon, which is deuided into equall partes: and the quarters of the Circles drawne to it (which are the partes of the verticall circle) which if they be wholly described, doe concurre and meet in the opposite pole c. of the Horizon. To these Circles



cles (as is afoze mentioned) is the Meridian added. Further, the letter c. doeth signifie the North, d. the South, b. the East, and g. the West. By which appeareth, that the horizon from the Meridian Circle a c f d. and a c f. (by which line the Circle is represented, passing by the verticall point and the true or Equinoctiall rising) is devided into foure quarters, b c, b d. as the two quarters orientall, g c, g d, the occidentall. In the orientall halfe of the Horizonte c b d, is c b. called the Northerly quarter, and b d. the Southerly. And in the Westerly halfe c g d. of which c g. is the Northerly quarter, and g d. called the Southerly.

The

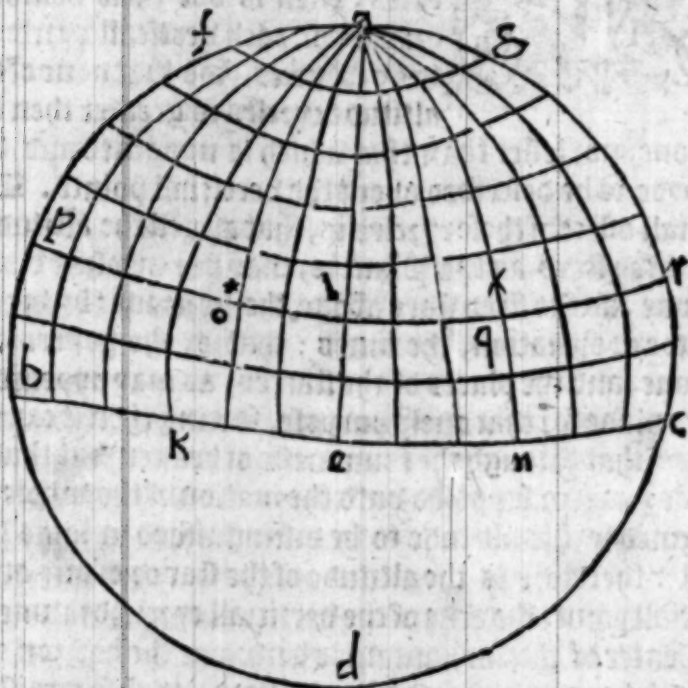
The Circles of the Altitude.



The Cycles of the altitudes bee those, which are equidistantly described about the toppe of places. As the verticall cycles doe deuide each of these cycles into 360. degrees, euen so doe these deuide a quarter of each verticall cycle into 90. degrees. So that none of the altitude cycles is greater then the horizons, no; lesser than that which is imagined and vnderstande to be described about the verticall pointe. The especiall office of these cycles is, that aswell the altitudes of the fixed stars as the Planets, may bee measured and knowne, as the fixed stars aboue the horizon: by which altitude or eleuation, the times; that is, the houres are knowne, and the places of the starres, as may appeare in tables made for that onely purpose. Saying then it cannot be (and that through the roundnesse of heauen) but that any star giuen or supposed vnto the motion of the whole, is imagined by his altitude to be distinguished in some Parallel: therefore is the altitude of the star or of any other celestiaall point, the arke of the verticall cycle, drawne by the Center of the star, contained betwene the horizon and the star giuen, which (as aforesaid written) is distinguished of the said parallell. The meeting and ioyning together of these cycles with the verticals, is not moued, but at the motion of the verticall point; which is none other, then the pole of the horizon, from which all the parallels of the altitudes, are imagined to be described by equall distances. But this (in mine opinion) is not to bee ouerpasse; that is, that any star, when it shall be equally distant from the meridian, either hath or may haue the same altitude from

from the horizon, as to the ele is offered in this figure following.

Where a b d c. is the Peridian: b e c. the greatest halfe of the Paralels of the horizon: f g. the least: b. the North, and c. the South: a. the point of the top: o. or q. the place of the starre given, by which a o k. or a q n, the verticall Circle passeth, and the like doth the Parallell p l k. The Arke ko. or n q. is affirmed to be the altitude or elevation



of the starre from the horizon, that endeth at the parallell polr. and p o. is the distance of the starre from the none, stead a p d c. Now when the starre (by the motion of the principall) is drawne vnto the point q. in which when the same shal be, it will be equally distant from the Peridian Circle: wherefore through the equal distance of the parallels, of which they be named, shall the Arke o k. be equall

equall to the Arken. Of this proceedeth and is caused that in the howers equidistant from the nonestead, as is the seauenth houre before none, and the fiste houre after none: likewise the eight and the fourth, the ninth and the thirde, the tenth and second, and so of the rest. The sunne obtaineth equal eleuations about the horizon. This much auaideth in the composition of making of dials, and giueth great light and breuity to the same practise, as may appere elsewhere: but the verticall Circles in the solyde Spheres and Globes, by one quarter of the Circle, depending of the verticall point vnto the horizon (diuided into 90. degrees) is declared.

The houre Circles.



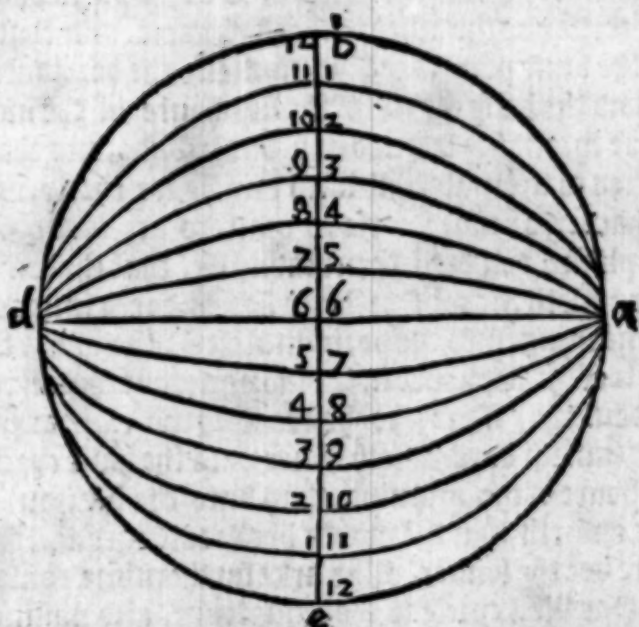
That the whole worke of dialles dependeth vpon the knowledge of the houre cycles; it is therefore requisite and necessarie to entreate fully of the cycles distinguishers of the houres, or at the least vter a brief instruction of this. First you shall vnderstande, that the Equatoure onely, which (as aforetaught) the sunne beeing either in the beginning of Aries or Libra, is regularly moued, aswel in the right, as thwart Horizon; and thereof is alwaies the one halfe above the horizon, & the other halfe hid vnder the Horizon. Through this his equall motion or regular motions, is it iudged woorthy and laudable: seeing by it the equall houres (as well by day as night) are attained and had. And this conceane, that there are twelue greater cycles vnderstode, which crosse the Equatoure at right angles, and passe by both the poles of the first mouer, from which the said equatour, is distinguished into 24. equall parts, which are called

led the distances or spaces of the houres, in that each be distant from other by 15. degrees. For they deuide the verticall, the Zodiacke, and the horizons into 24. partes, but vnequally: at which Poles the nearer partes to them are narrower then those which be and draw nearer to the equatour. And that these may clearer and perfecter be vnderstande, imagine your selfe to bee vnder the equatoure; that is, in the right Sphere: in such a standing shall the halfe meridian Cycle bee the line of the twelue houre, and the halfe horizontal circle, the line of the first houre before noon: and the other halfe of it, the line of the first houre at after none. By which imagination firmly conceiued, may a man imagine between the halfe horizontall cycle, and the halfe meridian cycle, to be other five halfe cycles firme and immouable, which are not mooued but as the verticall point is moued, being distant each from other by an equall distance, as by 15. degrees of the equatour. The first after the horizon, is applied to the seventh houre, & so forth of the rest. And in like maner between the meridian halfe cycle, and the occidentall horizon are other five cycles vnderstande (according to the former deuision) and that which followeth the meridian, shall be applied to the first houre, that which next followeth to the second houre, and so forth of the others. Besides, imagine the sun to ascend from the horizon, and when he shall be come vnto the first halfe cycle from the horizon, then shall he shed a shadowe furthest westward, and being drawne by vnto the second, shall make a shorter shadow, and the shadow shall alwaies (vntill the sun bee come vnto the halfe nonestæde cycle, where he sheddeth or sendeth a shadow) plum down right to the earth: but descending from the nonestæde vnto the West, the Sunne causeth then the like shadowes contrarie.

Further conceiue, that the Cre-træ of the worlde, in whose poles (as is afoze taught) all the houre cycles meet
to,

together in one, doeth performe & expresse the same, which the foresaid cyrcles taught: as by the sun dials the like is readily vnderstood and knowne.

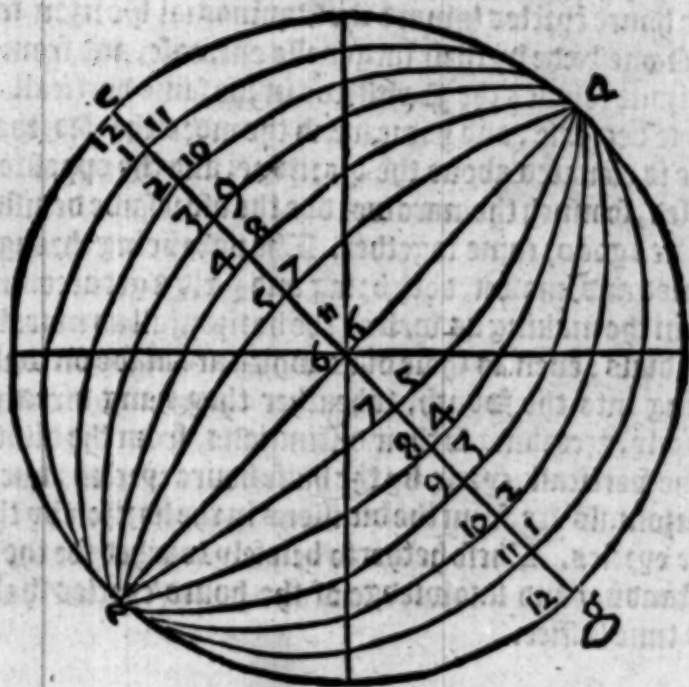
Which this Figure further explaineth, where a b d e. represent the Meridian, a i d. the right horizon, b i e. the Equatoure, d. the Northerly pole, and a. the Southerly pole. In these two poles doe all the hower Circles meet, as the same here appeareth vnto the eie, and the letter b. is the vertical point. The distinguishers of y^e howers by the nu^mbers added are manifest.



bers added are manifest. For a b d, is the halfe Meridian circle, as already saide: the letters a i d. doe represent as wel the halfe Oriental as the Occidental circle of the horizon: a b d i. is the halfe of the World aboue the Earth a e d the other halfe hidden. The eie of the beholder, imagine to stand in the point i. and each of the hower Circles aboue the horizon vnderstood and taken or v^sed twice together. To conclude this sphere doth offer and teach clearely and plainly

plainly all the former. So that the pole articke with the rest of the cyrcles must be raised aboue the horizon, and the halfe cyrcles of either first houre, seuered or deuided from the horizon. Of this ensueth, that the equatoure leaueth the verticall point, and howe much the Northerly pole is raised aboue the horizon, somuch doth the equatour depart from the verticall pointe (as afoze in the proper place is aptly demonstrated) & howe much one quarter of the halfe cyrcle of the first houre is raised together with the Pole, somuch the other quarter with the opposite pole is depressed and standeth vnder the horizon. Of this procedeth, that they crosse one the other in the East parte, and that in one and the same point, the Equinoctiall, the horizontall cyrcle, and the halfe Cyrcle of the first houre of the morning. These thzoughly learned and vnderstode, and the sphere applied to the materiall with any houre cyrcle, by which the harder or moze curious matters are made manifest and plaine; you shall then readily see, that the sun whiles hee runneth in the Northerly signes, doeth sooner come in the morning vnto the horizontal circle, then vnto the halfe cyrcle of the first houre in the morning: but the sun running in Southerly signes, he then causeth the contrary: that is, he attaineth or commeth sooner vnto the halfe cyrcle of the first houre of the morning, than vnto the horizon. And of this ensueth, that the nights here are longer, but the daies there bee the longer. The arke furthermoze contained in the Parallell cyrcle to the Equatoure, and passing by the suns place (between the horizon and the halfe cyrcle of the first houre) is the difference betweene the equinoctiall day, and purposed day, whatsoeuer or how much the same be, which is worthily to be noted. Besides these, it greatly auaieth to vnderstand in these thre cyrcles, the equinoctiall, the horizon, and verticall cyrcle, that the vpper faces ending at those cyrcles, the equinoctiall truely by the same receiueth and causeth a deuision that the vpper face also is
sup

supplied and placed vnder, and receiueth and maketh the like; that is, equall. But the vpper face which is placed and standing vnder the horizone, doeth receiue and make an vnequall deuision, even the same that the horizone is, which of the houre cycles is vnequally deuided. And the like also may be gathered and iudged of the deuision of the vpper face of the verticall cycle, which (even as his cycle) is vnequally deuided. But that these (for breuity) may readier and plainer appeare, conceiue this figure following demonstrated, which without long circumstances



of words, doth evidently set forth that which is set down before. The letters b h f. represent the Meridian Circle. g n c. the Equatour, h n d. the tiltet Horizon, b n f. the verticall circle: a. the northerly Pole, c. the Southerly pole:
D.

pole, h a. the eleuation of the pole aboue the horizon, d e. the submerſion or ſtanding vnder of the pole, right againſt the point n. is the pointe in which (as afore taught) the thwart horizon h n d. and the equatour c n g. and the halfe cyrcle of the ſixt houre of the morning a n e. together with the verticall cyrcle b f. doe croſſe one the other in the Eaſt. If you conſider the deuifions of the halfe cyrcle houres in the Horizon h n d. you ſhall ſee them to bee together vnequall, as nearer to the Eaſt point n. but larger to the point h; that is, narrower to the meridian cyrcle. And euen the ſame hapneth in the verticall cyrcle b n f. that is, that the halfe houre cyrcles toward the Equinoctial Horizon from the ſoutheſide by their largeneſſe entreaſe, and from the Horizon toward the ſoutheſide in the ſame verticall circle doe decreaſe: and howe much the more the ſoutherly Pole is eleuated aboue the Horizon, and the oppoſite depreſſed, ſo much the narrower doe the aforeſaide deuifions alwaies goe or come together. The now being thoroughly learned and known, doth bring and yeld a great commodity in the making as well of the horizontall as murall or wall dials: euen as thoſe dials which are made on walles looking into the South, wheather they hang directly or thwarly, according to their diſtinctions, from the diuiſion of the verticall cyrcle by the halfe houre cyrcles: but the Horizontals are, from the diuiſions in the horizon by thoſe halfe cyrcles. Theſe hether to briefly touched for the vnderſtanding and knowledge of the houre cyrcles ſhall at this time ſuffice.

The Circles deuiding the twelue

houses of Heaven, into dials, and dials

Now reſteth to entreate of the cyrcles diſtinguiſhers of the houſes, and the cyrcle of the poſitions: but firſt I will write of the diſtinguiſhers of the houſes. As there are

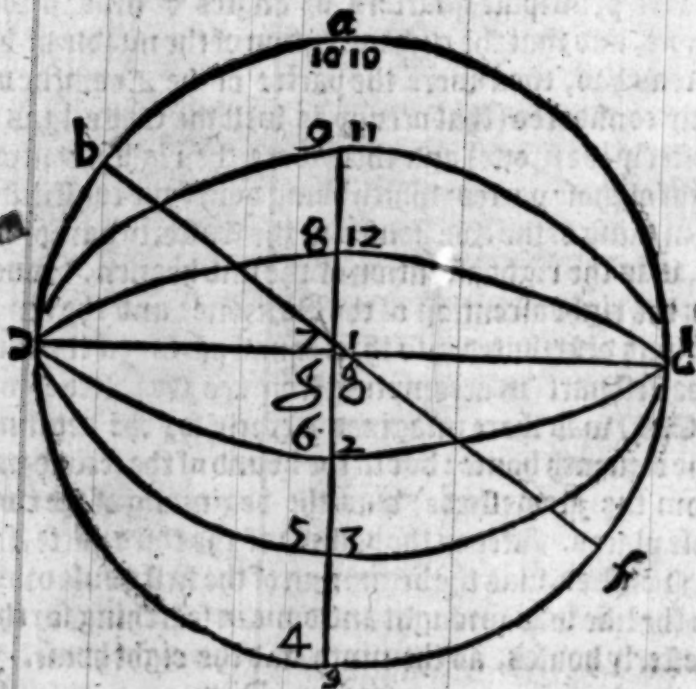
are six cycles that are imagined of the astronomers, by which heauen is deuided into twelue parts; among which are the Horizon and meridian, whereby the whole is deuided into foure equall parts: and those twelue parts, are (of the astronomers) called mansions or houses. But as touching the constitution and forming of the celestial houses, there are sundry old and late opinions, but whether opinion is the worthier, or to be the rather allowed, is not here mente to bee stode vpon, nor aptely belongeth to the matter I entreat of, so well as in the proper place is agreeing: yet certaine, and especially the auncient, which were Campanus, a singular mathematician and astronmer, deuided the houses by the six cycles of heauen, meeting and ioyning at the Poles of the world; from which they deuided the whole heauen (together with the meridiene) into twelue equal houses. But for a better and readier instruction, they formed and diuide them in this maner. After the foure principall quarters or angles of heauen were drawne, and that the right ascension of the middle of heauen was had, then were the partes of the Zodiacke diligently considered (that occupy as well the Easterly as the Westerly Horizon) and then were the right ascensions sought of those partes: which being done, the constitution and making of the two houses in the Easterly part of heauen, was the right ascension of the mid heauen, deducted from the right ascension of the Horizon: and the remayner, was distributed into three equall parts. In the bound of the first part (in accompting from the Pointed toward the East) was there imagined a cycle for the beginning of the eleuenth house: but in the bound of the second parte (from the Pointed) was the beginning of the twelue house placed. After in the bounde of the third parte, from the Pointed, was the beginning of the first house drawn: and the like was wrought and done in searching for the 2. Westerly houses, as the ninth and the eight house. For

¶ y.

they

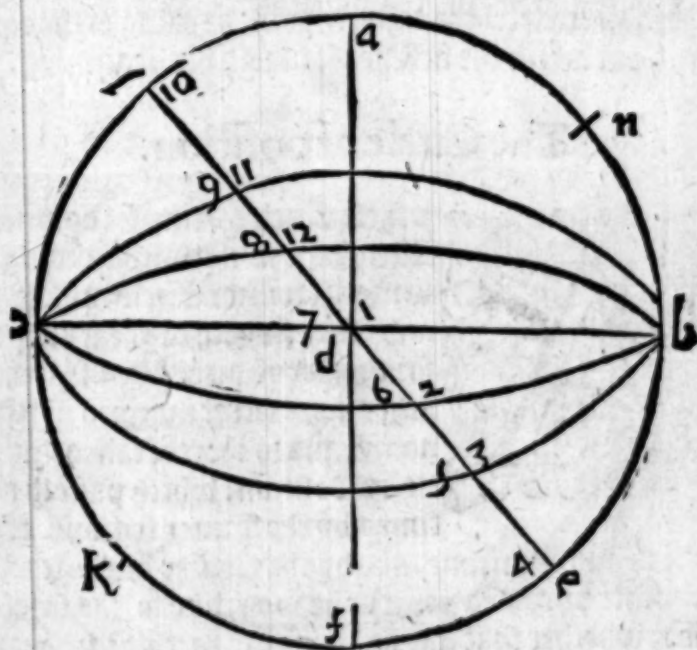
they deducted and subtrahed the right ascention of γ west part, from the right ascention of the mid heauen or none-
stead, and the remainer or rest (as afoze taught) was di-
stributed into three equall parts. After that in the ende of
the first portion (from the nonestead towards the West)
the auncients constituted or placed the bound of the ninth
house, with the circle comming from the poles of γ world:
and in the bound of the second portion, was the beginning
of the eight house sozmed. These attained, the degrees
and partes of the degrees of the Zodiack answering to ech
arkes of the Equatoure, were sought in the Tables of the
right sphere: but the houses standing vnder, were defined
and made like to their opposites. And seeing this maner of
sozming the houses is vnperfect, therefore shal here no fur-
ther be taught of the same.

But the other Astronomers, as Campanus and Gazu-



lus, doe otherwise handle this matter, which with the 4. circles in the sections of the Horizon and Meridian making and ioining, divided (together with the Meridiane and Horizon) the whole heauen into twelue equal parts: which equalitie in the circle passing by the Zenith, was the equinoctiall rising considered, as the same may more plainer and evidently appeare in this figure here demonstrated.

In which a c. is the verticall circle, crossing a d c. at right angles: f g b. the equatour: d g c. the horizon, d. and c. be the points in which the distinguishers of the houses concur and meet; which also do make equall distinctions in the verticall circle, and thereby be the houses noted and divided.



But the later Astronomers, moued by the authority of the incomparable Mathematician Regiomontanus, inuē-
d.iii.
ted

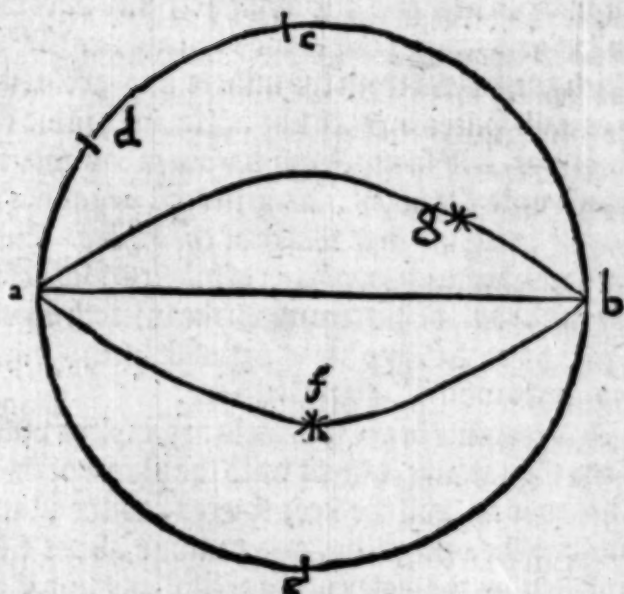
ted and deuised another order of the houses, more agreeing to reason than the former. For they deuised the quarters of the equatour, comprehended betwene the horizon and noonstead, into three equall spaces, and by each section they imagined great circles, ioyning in the sections of the Meridian and horizon, as the former, Although all these are plainer and more evidently taught and known in the materiall Sphere, yet we thought good to speak somewhat (as our possibility serueth) in plaine forme.

Wherefore grant that a f c. is the Meridian, a. the Top, n. the Northerly pole: k. the Southerly pole, b. and c. the points of the sections of the horizon and Meridian, where the distinguishers of the houses concur and meet, which also are imagined by the equall distinctions of the equatour e i l. as to the eye sufficiently appeareth, that b i c. is the horizon circle, d. the easterly point or rising of the equatour, from which the first house taketh his beginning.

The Circle of position.



L these Circles being set down, the Astronomers notwithstanding do write of another Circle, whose vse and office serueth to great purpose, for the Art of directing & searching other more secret matters in Astronomy, and is thereof called the circle of Position, which passeth at all times by the former sections of the meridian and Horizonte, and by the Center of the star, or of any other purposed point in heauen, like to the foresaid circles, whether that star be aboue the earth, or vnder the earth. That this may clearly appeare, marke and consider this figure here expressed, where the letter c. representeth the top pointe, d. the Northerly Pole, e. the opposite pole.



pole, a g b f. the cyrcle of the position passing by the sections of the horizon and meridian, b c d e. the meridian a b. the Horizon, g f. the Centers of the stars (of which the one is in g. above the earth, and the other vnder the earth in the point f.) And many other cyrcles besides all these, which hetherto haue bene described, may bee inuented and imagined in the sphere, for the necessity of the workings.

The definitions, names, and offices of the foure lesser Circles.



The Parallels are lesser cyrcles, which from either of the greater circles drawen thwartly on the sphere, doe equally distand and bee distant from the Equatoure or Zodiacke toward their poles : so y they doe not denide the Sphere into equall halfe Spheres, but into vnequall portions

ons. For seeing the sphere from the middle stretcheth out draweth by litle and litle straighter and narrower toward the furthest and highest toppes: euen so must the parallels which are distant from the middle and greatest, and that by equall spaces on each side agreeing, drawe of necessity narrower, and so much the narrower, as they nearer approach vnto the poles. As writeth Theodosius in the sixte proposition of his first Booke of the sphere. And the same Autho: in the 14 proposition of his first Booke of the sphere, and in the first, of his second Booke writeth, that all the parallels haue the same poles agreeing with the greater circles vnto which the parallels are.

And certaine of the Paralels are applied vnto the plaine of the Equatoure, others vnto the plaine of the eclipticke. These doe as well the fixed starres, as the planets placed without the eclipticke, and drawne about the Centre stretched by the poles of the eclipticke and Center of the worlde describe: yet do all their centers consist in the Centre of the Zodiack, and the middle circle of them, and the greatest is the eclipticke. These also doe the same stars, and the verticall or toppe points of each places, or any other applied vnto the plaine of the equatour, drawne as it were by the first mouer about the Centre and poles of the worlde define. And the Centers of these be in the Centre of the worlde or equatoure, but the middle and greatest of these, is the equatour.

It is manifest by that afore taught, that the sun in euery day doth gaine toward the East (against the dayly motion) one degree of the Zodiack: and of this hapneth, that he in each day through the thwartnesse of the Zodiack describeth a certaine newe circle in heauen, and in the nexte day another, and so forth by order, as the like may be compared by a small corde, winded close about a spun or top, beginning from the foote vprward, euen so the sun beginning to turne againe at the first degree of Capricorne, doth
 euery

euery day after change a new Parallel, vntill hee become backe vnto the first degree of Cancer, and by and by after returned from Cancer, he in the like order goeth vnto the Capricorne: so that in the next day following, the Sun riseth not with the same Parallell aboue the Horizon that hee did in the morning before, nor shall not run the nexte morrow in that Parallel that he did in this day. And each of these Parallels (euen as the greater cyrcles) containe 360. degrees, which be so much lesser, then the degrees of the greater cyrcles, and occupy or comprehend somuch the lesser space in heauen, as answereth to the vpper face of the earth, as by how much the more fro the compasse and largenelle of the greatest cyrcle they lacke, by reason of the distance. And although they yeld and be lesse in the quantity, yet vnto the degrees of the greatest cyrcles be they agreeable and like, as (writeth Theodosius) in the 14. proposition of his second booke of the sphere.

These lesser cyrcles, do offer and teach sundry vtilities. First the Parallels, of which on this side and beyond the Equatour, are 182, that the sun yearly by his dayly motion describeth: and doe expresse the causes of the continuall equallity of the daies in the right Sphere, and of the vnequalnesse in the thwart or bowing sphere, and where the day spaces are encreased and lengthened, there the night spaces be lessened and decreased: and being otherwise they shew the contrary.

In the second, the Parallels (which the verticall points forme) when they expresse the boundes of the latitudes of places, then are they standing vnder, by which their longitudes or distances from the West are accompted.

In the third, the Parallels (which either the Planets or the fixed stars describe) referred vnto the Equatour, do expresse the boundes of their drawings or motions from the equatour. The others or rest, which applied vnto the eclipticke described, doe shew the bounds of the latitudes:
and

and that fo2 how long time they tarry aboue the earth, o2 otherwise hid within the earth, and vnder the Horizon, both either shew.

In the fourth, the greatest and chiefest vtilities of the Parallels are, that which on the habitable earth the practitioners seuer by such distances, as by how much y greatest artificiall daies are by a quarter of an houre longer increased and extended. fo2 they distinguish the habitable earth (and that by obseruation) into certain necessary spaces, and doe indicate the regular increasings of the daies, and what is common to each dwelling vnder those parallels, in asmuch as the quantities, the increasings and diminishinges of the dayes and nightes, the risings and settings of the stars, the Pownsterde shadowes, and the nature of the Winter and Summer but those which are contrary, as that there is a difference & diuersity of the dwelling places being vnder diuers Parallels, they indoe bee necessary vnto the distribution and description of the clymate.

Although the number of these cycles bee so infinite, as is the infinite variety of the stars and verticall points: yet are there foure vsually rehearsed in these Elements o2 introduction, that be especially noted and described by peculiar names: and fo2 the same cause (as saemeth to mee) in that they deuide the whole Globe of heauen and earth into fīue Zones, and these applied vnto the plaine o2 flat of the equatour.

The tropicke of Cancer, o2 summer tropicke.

The tropicke of Capricorne, o2 winter tropicke.

The articke o2 Northerly Pole.

The antarticke, o2 Southerly Pole.

Which

Which Circles are called the
Tropickes.



The Sun (according to the former words) through the motion of the first mouer is in 24. houres, drawn once about : and for that hee is carried in the thwart Cycle, and in the same by his proper motion cha- geth dayly vnto other places of the Zodiacke, it must needs ensue, that he describeth in each day a new parallel. And those doeth the sun repeat in the partes of the Zodiaek, which be equidistant from the solsticiall points ; in such wise, that they be in the whole 182. cycles. And these do they call the cycles of the natural daies, of which the vttermost and furthest that include the suns way, are named the Tropicks, which is (in English) the sun bounds, in that the sunne neuer passeth them, neither toward the North nor toward the South : but after his touching of each, he returneth againe. The one of these called the tropicke of Cancer, and the other the tropicke of Capricorne.

Why these are called the
Tropickes.



They are named the Tropicks, of the Greeke word *Tropikoi*, which is in English, the turnings againe ; in that when the Sun is digressed from the Equatoure and come vnto those, hee turneth backe againe. Also the Tropicke cycles touch the Zodiack, at the beginnings of Cancer and Capricorne, of which the one is cal-

is called the Tropicke of Cancer, and the other of Capricorne, the one being Northerly, and the other Southerly. And as to our dwelling, the one is called the summer Circle, and the other the Winter. So that when the sun toucheth any of these, he turneth againe, and is carried toward the other. As by this example further appeareth, where all that season and time (from the twelfth day of December vnto the eleventh day of June) a manne may perceiue the Sunne euery day arising higher and higher: and when he is at the highest ouer our heades, that day doth he by his course describe the summer Tropicke: from which againe turning, the sunne euery day after draweth lower and lower from our verticall pointe, vntill he be come againe vnto the lowest. In which twelfth day of December (not going any further toward the South, but being come vnto the beginning of Capricorne) he describeth the winter Tropicke.

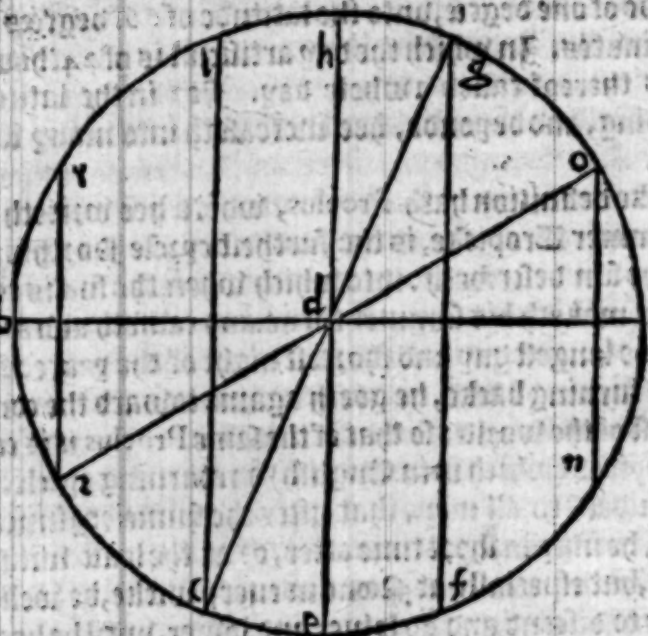
The Tropicke of Cancer is a lesser Circle, which the sunne describeth at the entring into the beginning therof, and is drawne by the daily motion, whose plaine or flat passeth not by the center of the earth: and it is one of the naturall Circles which is outermost, described of the sun toward the North, and drawne by the beginning of Cancer. And it hath also his name of the standing, in that the same is the bound of the sunnes iourney or course toward the North, and the highest comming vnto vs: vnto which being brought, he turneth backe, and directeth his course into the South; of which that place is called *Trope*. It is continually distant from the Equatour, by the quantity of the suns greatest declination, which at this day is of 23. degrees, 28. minutes, and two fifts almost: and it encloseth also the suns way, and doth besides, with the other 3. Parallels, deuide the Zones of heauen and earth. Further, this is named the cyrcle of the summer solstice, by the same reason, in that it is drawne by the points of the summer

mer solstice. And the Northerly Tropicke in that it is the Northerly part of the world. And the summer cyrcle, so that the Sun in the summer falleth into this cyrcle. Also this cyrcle in all the Northerly tract is on this wise, that the greater part or portion is aboue the Horizon, and the lesser part (as to vs) vnder the Horizon: so that the sunne runing in that cyrcle, causeth the longest day of summer. And whiles the sun describeth these cyrcles, the dayes bee longer then the nightes. For the longest day increaseth from minute to minute, from houre to houre, and from the latitude of one degree, vnto the latitude of 66. degrees, and 30. minutes. In which the day artificial is of 24. houres, and is thereof called a whole day. For in the latitudes following, and beyonde, hee increaseth into many whole daies.

A like definition hath Proclus, where hee writeth that the summer Tropicke, is the furthest cyrcle Northwarde that the sun describeth: into which when the sun is come, he then maketh his summer turne, and causeth also at that time the longest day and shortest night of the yeare: from which turning backe, he goeth againe toward the contrary coast of the world: so that of the same Proclus it is called a Tropicke (which is in English) a returning cyrcle. For it is euident to all men, that after the sunne beginneth to turne, he may in short time after, or at the least within 5. dayes, but especially at pōone in euery wake, be well perceived to discend and go lower and lower, vntil he become vnto the Tropicke of Capricorne or the winter cyrcle: where he turneth againe, as you may plainly learne and vnderstand by the former description of that cyrcle.

The Tropicke of Capricorne is a lesser cyrcle, and one of the naturall cyrcles, which is by the like space distant from the Equatoure into the South, and described of the sun in the beginning of Capricorne, as being vttermost toward the South (which is the bound of the suns greatest

departure from vs, and of his longest digression vnto the South) that he defineth and maketh. This cycle also is called the winter Solstice, and winter Tropicke: in that when the sun cometh into this cycle, it is presently winter: that is, the shortest day of the yeare. Also the lesser portion of this cycle is to vs above the horizon, and the greater beneath or vnder the Horizon. Besides the suns iourney enbeth at the south, and crosseth or devideth both the burning and temperate Southerly Zone.



The By small or winter tropicke (as writeth Proclus) that is furthest toward the South, of all those which the sunne describeth by his drawing about of the first mouer: into which when the sunne falleth, he causeth his winterly returne: so that the longest night of the yeare and shortest day, is at that time procured. From which he goeth

no further toward the South, but returneth vnto the contrary quarter of the world: and hereof this Circle is called a Tropicke, or circle of returne. Now these three are principally noted: the equatour, and the two Tropickes, for the course of the sunne. What the instructions of the two Tropicks alsoe spoken of, may more perfectly be vnderstande, concerne this figure heere demonstrated: In which a b b c. is the meridian, a d b. the right Horizon d. the Center of the principall a. the northerly Pole, b. the Southerly Pole, g d c. the cyrcle of the Zodiacke, h d e. the Equatour, which here is ment to be abatingly described, when the sun shall bee in the center of the earth, or in the true section of the Equatoure and Zodiacke, as in the letter d. from which point when the sun returnes toward the northerly pole a. vnder the cyrcle g d c. he then describeth in each day by the motion of the first mouer each Parallels, vntill he be come in the Meridiane vnto the point g, from which hee can not further ascend toward our Zenith in the meridian. Of which in the same day, the sun describeth g f. the parallell to the equatour, which is called the Tropicke of Cancer, in that the sun beginneth from this place to approach or draw neerer to the Equatoure; vnto which when the sun shall come, hee then descendeth vnto the neather halfe sphere, in the halfe cyrcle d c. Vee being come againe vnto the point c, both from his center by the motion of the principall or first mouer in the Poles of the world, describe the Parallell e. that is, the tropicke of Capricorne.

The Polare cyrcles, are two of the lesser cyrcles neere to the Poles of the world, being alike equal distant to the equatour, which vpon the Poles of the equatour described are drawne by the Poles of the Zodiacke. And these are named the Polare Cyrcles, in that they bee neere to the Poles: of which, that neere to the Pole arcticke, is called the arcticke cyrcle, of the greater or lesser Beare drawne

in

in it, or for that this cyrcle is described about the pole arcticke: the other that is right against. is named the antarticke Cyrcle, in that it is drawne aboute the Antarticke Pole.

And thus, the arcticke is a lesser cyrcle, which the Northerly pole of the Zodiacke is so far distant from the Pole arcticke of the world, as is the suns greatest declination: or as Proclus writeth, that the fore foot of the greater Beare by the dayly motion sojourneth. The same cyrcle (after the minde of the learned) is distant from the equatour 66. degrees, and 30. minutes almost. To whome this altitude is higher by 23. degrees, and almost 29. minutes. To those parts of the earth is the pole arcticke extant in sight, and continually appeareth. It also secludeth and parteth the vntemperate Northerly Zone, from the next temperate Zone: where the solsticiall Tropicke is made the Northerly cyrcle, and in that place vnder this altitude of the pole 66. degrees, and 31. minutes: there all the stars and images contained from the solsticiall Tropicke vnto the Pole are scene: as both the Beares, the Dragon, Cepheus, Cassiopia, Perseus, Auriga or the Carrier, whole Bores (except from the knees downward) the crowne Hercules (except the head and right arme) the Harpe, the Swan, the great Horse Andromeda (except the left Cubit) the halfe of the Northerly Fish almost, Delatton, a part of the backe of Taurus, the necke and Northerly Horne, a great parte of Gemini, and the head and necke of Leo.

And not vnlike to the former, doth Proclus describe them: where hee writeth, that the Northerly cyrcle is the same, which of all those that to vs continually be seen or appeare, is so true the greatest: and that also toucheth the Horizon at one onely point, being wholly described aboute the earth. And the stars that are inclosed within this cyrcle, do neither rise nor set, but are continually seen all the night drawn about the Pole.

The

The South or antarticke cyrcle, is thus defined of him; that the same is equal and equidistant to the Southerly or articke cyrcle, and toucheth the Horizon at one point. The whole of this cyrcle is hidden vnder our Horizonte, so that all the stars placed and drawn in it, abide ever out of sight to vs.

The like description that the antarticke Parallell is a lesser Cyrcle, which the Southerly Pole of the Zodiacke draweth about as it were by the dayly motion, doeth describe about the Southerly toppe of the world, and is by a like space distant from the Equatoure and the antarticke pole of the world, as the articke is from his opposite. And doth seporate or deuide the vntemperate Southerly Zone from the next temperate Zone.

Further it is manifest, that the distance of the Poles of the eclipticke from the poles of the world, doe agree with the greatest bowing or declination of the eclipticke or the sun: In that the poles from their cyrcles, bee alwaies distant a quarter of the cyrcle, and the colure of the solstices, is here taken so that which comprehendeth either Pole. And when the quarters standing betwene the poles, and the cyrcles of the poles, be in themselves, or betwene one the other equall, as the arke of the same cyrcle, then the middle arke common to both, which (as exempted) goeth betwene the poles of the world and the eclipticke, as it parteth and leaueth them equall. For the one halfe of the other equall arks, is from the poles of the eclipticke vnto the poles of the world, and the other, is from the furthest point of the eclipticke vnto the equatour. By which it appeareth, that so much is the distance of the poles of the Eclipticke from the poles of the world, as is the suns greatest declination, being 23. degrees, and 28. minutes, and two fiftes almost. And thus, that the pole of the Zodiacke is far distant from the pole of the world, as is the greatest declination of the sun from the Equinoctiall cyrcle: and by

the equidistance also on each side of the arctick cyrcle from the Pole of the world, that that part of the Colure comprehended betwene the first point of Cancer and the arcticke cyrcle, is almost double so much vnto the greatest declination of the sun.

And if circumspectly you consider the manner of the motions, you shall readily perceiue that those cyrcles which euer more be of like largenesse, increase and decrease together with the twoe Tropicke cyrcles, according to the increase or decrease of the suns declination. As appeareth by the letter n. in the foresaid figure, that representeth the Northerly pole of the ecclipticke or Zodiack, moued from the letter n. into o. by the motion of the first moouer, and returning againe into the point n, shall be moued the cyrcle describing n o. being distant from the Northerly pole as much as is the suns greatest declination h g. as hereafter by demonstration shall plainer appeare. And this cyrcle named the arcticke. in that it is described by the arcticke of the Zodiacke. The like is described from the point r. being the pole antarcticke, by the motion from r. vnto s. and returning againe vnto r. so that the antarcticke cyrcle r s. is equall to his opposite, and equidistant to the Equatoure.

This probation, that the distaunce of the Poles of the worlde and Zodiacke, is equall to the suns greatest declination, doth require before hand, these three propositions. The first that the quarters of each cyrcle any where taken be in themselves or betwene one another equall. The second, that the poles by a quarter; that is, by 90. degrees, be distant from their proper cyrcle. The third, that the equals deducted from their equalles, then doe the equalles rest.

As for example, if you bozowe two fourthes in one and the same Colure cyrcle. that is the Solsticiall of the same parte, where it passeth by the beginning of Capricorne,
and

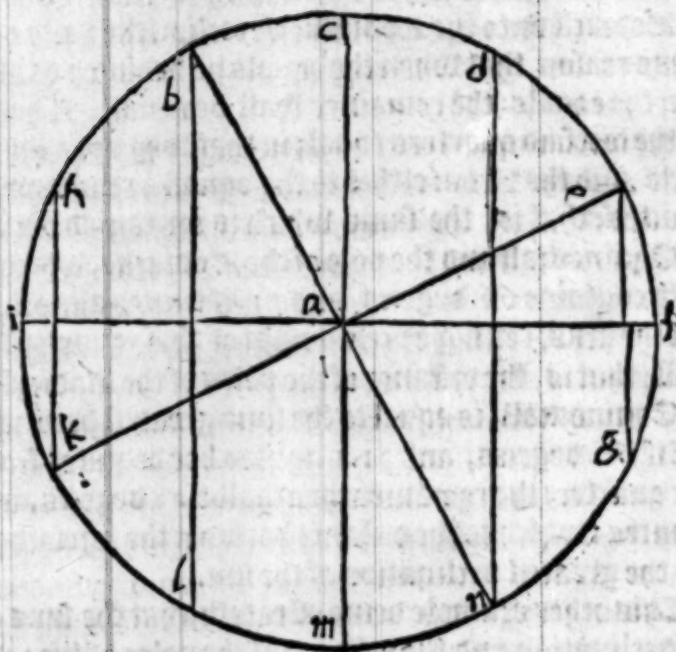
and is the like from the pole of the worlde vnto the Equinoctiall, and that other, is that which is from the Pole of the Zodiack vnto the Zodiacke or eclipticke: and of this I thus reason, that when the equals be deducted or abated from the equals, the remainder shall be equall. Therefore are the foresaid quarters equal, in that they be in the same cyrcle, and that from either is the equall or common arke deducted; that is, the same which is contained betwene the Equinoctiall and the pole of the Zodiacke, which arke doeth containe 66. degrees. and 31. minutes almost. So that the arks, resting or remaining of these quarters be equall; that is, the distance of the poles of the Zodiack, and the Equinoctiall, is equal to the suns greatest declination. For if 66. degrees, and 31. minutes bee deducted from either quarter, the remainder then shalbe 23 degrees, and 31 minutes: which is the distance betwene the foresaid poles and the greatest declination of the sun.

This other example demonstrateth, that the suns greatest declination and the distance of the poles of the zodiack or eclipticke from the poles of the worlde, is equall and of like largenes, and that what soeuer hapneth to the distances of the said Poles. For as this increaseth or decreaseth, the like doth that decrease or increase. Of this it is manifest, that the two foresaide articke cyrcles, is nowe in our time lesser thzough the decreasing of the suns greatest declination, and that the Tropickes are greater then they were in Ptholomies time.

The example here followeth, where i f. representeth the Cre tre of the worlde, e a k. the Cre-tre of the Zodiacke, c l m n. the Meridian or Colure of the Solsticis, c m. the Equatour, b l. the Tropicke of Cancer, d n. the Tropicke of Capricorne, I. the Pole articke, F. the Antarticke and opposite pole to it, k. the pole of the Zodiacke, and c. his opposite, b c. the greatest declination of the Sunne, which in our time the practicioners haue founde to be of 23. de-

grees,

grees,



grées, 28. minutes, and 30. seconds: which in Ptholomie's time was of 23. degrés, 51. minutes, and 20. secondes. The letters *c g.* and *h k.* be the two articke cyrcles. The arke *b c.* is equall to the arke *i k.* in such wise, that it may plainly appeare that *b h k.* and *c i k.* be the two quarters of one and the same cyrcle, *f c k m.* All the quarters of the cyrcle bee a like equall one to the other, *c b i.* and *b i k.* bee the two quarters, in one and the same solstitial Colure cyrcle. So that *c b i.* is equal to that *b i k.* and the ark *b i.* is to both the quarters equall or common. If then the equalles bee from the equals deducted, the remainder shall be equall, as aboue taught. For from the saide equall quarters, *c b i.* & *b i k.* deduct the equall, that is *b i.* or the common. And the remaining arks, of the said equall quarters, shall be in themselves equall, that is, *c b.* shall bee equall to the arke *i k.*

ik. as agréeth to be wrought.

The offices or vtilities of the
four lesser Cyrcles.

1 The office of the Solsticiall Tropicke: (after the Greekes) is to define the longest summer day: and the winter Tropicke, to determine the shortest winter day and longest night. For Proclus to finde the longest day, did diuide the summer solstice into 8.

equall partes; of which so denuded, he affirmed thre parts to be continually hidde vnder the horizon, and fve aboue. The truth of which is known, if the Sphere bee rectified for the latitude of 41. degrees, where by this diuision the longest day containeth 15. hours and the night but 9. houres.

2 Many and notable offices doe the Tropicke cyrcles offer, as well vnto the composition of dialles, as vnto the preparing many other Instruments in Astronomie.

3 They declare the places of the Ecclypticke, in which the suns solstices are caused: whereof the longest or shortest daies by them are knowne. And thus, they declare in every standing of the sphere, the longest and shortest day, with their quantity.

4 They include the Suns way, in that they bee as the bounds including the Region in heauen, in which the sun is continually moued.

5 They declare the suns greatest declination, as afores hath bene often taught.

6 They separte in heauen, the burning Zone, from the two temperate Zones.

But of the Polare cyrcles, these be the chiefest and especiallest vtilities.

R. iy.

1 They

1 They indicate oꝝ shewe the Poles of the Zodiacke, and howe farre they bee distaunt from the Poles of the world.

2 They inclose those stars which euer appeare aboue our Horizon, and those in like maner right against being alwaies hid vnto vs. But foꝛ that euery seueral Climate (hath disagreeing from other Climates these cyrcles) their distance theretoꝛ cannot bee certaine from the other Parallell cyrcles, sauing foꝛ one Region certaine, as neither their quantities, noꝛ their order. Foꝛ in that place, where the altitude of the pole is lesse then 66. degrees and a halfe, these cyrcles there are lesse then the Tropicks, and in order are betwene them and the poles, and is from the pole continually distant by so many degrees, as the pole in that country is raised aboue the Horizon. So that in the same place, the Pole raised more then 66. degrees and a halfe. The Tropicke then is aboue the horizon, as the like may be vnderstode by that place called Wardehouse. So that in the same Climate, the arcticke cyrcle is greater then the Tropicke of Cancer, as witnesseth the learned Stoefflerus, Iustingensis.

3 They distinguish (after the mind of the Greeks) the cold Zones, from the temperate. Which Perio denieth, affirming that the arcticke and antarcticke cyrcles, keeping no vniformitie to all countries and being vncertaine and variable boundes, can limit any certaine place. Foꝛ the temperate Zones are places certaine, the arcticke and antarcticke cyrcles bee changeable limits, theretoꝛ cannot they be as bounds of the temperate Zones: yet dooth bee better allowe and agree vnto that, that the Tropicks bee bounds of the temperate zones. So that changeable limits (by this argument) cannot be appointed as bounds to vnchangeable places.

4 They deuide togither with the Tropicks, all heauen into fve parts oꝛ Regions, which they call zones.

The

The descriptions, names, qualities,
and vtilities of the
Zones.



The foure lesser cyrcles called Parallels (that were afore described, doe deuide the whole heauen towards the Poles into fve spaces: which that heauen might bee compassed aboute with these larger swathes, the astronomers of the same called them Zones, or otherwise of the Latines Girdils. The Cosmographers by the same imagination applied, doe also dispose and distribute the whole Globe of the earth into fve rowmes or spaces, lying directly vnder, and agreeable in proportion to them in heauen.

Wherefore a zone (after the minde of the Greekes) is a portion, tract, or space of heauen, or earth, betwene the two Parallels or lesser cyrcles, being highest equidistant, or contained betwene the rowme equidistant and Pole of the world, and gyrdeth or compasseth as it were the heauen or earth. And thus, a zone is a space of earth like to the two Parallels or lesser cyrcles aboue, which the astronomers imagine to run on the vpper face of the sphere. And as the whole portion included by the two Tropicks called the burning zone, doth compass heauen as a gyrdle: euen so imagine the rowme of the earth, lying right vnder the Tropicks.

The zones haue sundry names, for of the Greekes they be called *zone*, and of the Latines by a borrowed word *Zona*, as may appeare by Iulius Firmicus, Macrobius, Virgilius, Ouide, and other Latines. That heauen or earth is imagined to bee gyrded about with these. Martianus nameth

meth them swathes, Tully and Macrobius nameth them by the like reason gydes. Ouide nameth them plagues; that is, rowes or spaces.

And how many zones they bee, may easily appeare, in that the astrologians, Geographers, Physitions and Poets, do deuide as well the heauen as earth into five rowes or spaces, by the foure Parallels or lesser cyrcles: of which there bee two maner of zones: the celestiaall and the earthlie.

The celestiaall, are the cause of the earthly, in that the earthly lie directly vnder them. And of the zones, the celestiaall bee they which the astronomers by imagination describe and distribute in the hollow of heauen: the earthly, be they which lie perpendicularly vnder. And both also be temperate, and vntemperate zones.

The celestiaall zones, in that they haue nothing of the elementary qualities, therefore doe they not by heat burne and scorch, nor by cold make stiffe: nor cause a temperate mixture of qualities or temperatnesse, yet are they noted and discerned by the names of the qualities; as the earthly zones, which being the autho^r of the sun, and fountaine both of light and heate, and running continually in the middle zone of heauen is diuersly felt, according to the maner of the distance.

¶ Thus, there are no qualities formally attributed to the celestiaall zones, but to them onely vertually, which is on this wise to be vnderstode, as that the celestiaall zones of themselves be neither cold, hot, nor temperate, but are so called through the suns declination from the equatour, as well into the North, as into the South quarter of the world: In the which declination, is the like matter felte, as well in the suns right sending downe of beames, as in the thwart proiection of the on the vpper face of the earth, which diuersly changeth the heat &c.

The scorching or vntemperate middle Zone which
through

through the heat and burning beames, the sun there causeth, when he is ouer the head or in the *Powerfull* place) is contained betwene the boundes of the sunnes iourney which the two Tropicks make, and includeth 47. degrees of heauen. For the two Tropicks are on either side the equatoure, so that it bleth the middle roome in the burning zone, from which the sun towarde the North and South, neuer declineth aboue 23. degrees, and 29. minutes. By which appeareth, that it is there as hot in the middle of winter, as it is in Spaine in the middle of summer: and therefore not disagreeing to that which the auncient Cosmographers wrote, that the countries lying vnder this space, or rather vnder the equatour, is vnhabited through the burning heate: and of them for this cause, named the burning or scorching zone. But of later yeares it is found contrary, in that at Molucca, Good-hope, Calicute, and Samatra, rich dugges, and other fine spices haue beene there gotten by the Spaniards and Portugals, and rarely haunted by them, as at this day the same is thoroughly known to many: which also confesse that the places vnder the Equinotiall, and the rich City Calicute, being by the sea coast of Inde, standing betwene the equatour and our Tropicke of Cancer, and vnto the other Tropicke South vnder the burning zone, that the places is habitable and peopled, although very cumbersome with extremity of heat. Also that space on earth containeth 687. Germane miles, or 23500. furlongs.

Ptholomie and Auicen affirme, that the places betwene the equatour and summer Tropicke is habitable, and that many Cities bee there, although the sunne in those places through his direct beames (and especially vnder the equatour) doth by the ouer much heat and continual heat, burn and mightily scorch. The like doe sundry others affirme, which write, that those places is conuenient for the life of creatures, in that vnder the equatour there bee many waters.

ters, which although resolved and run through the heate, yet doe they breathe and send upward colde vapors, which the sun continually maintaineth in drawing up through his vehement heat, and sending down mighty showers of raine: which vapors in the night (through the suns furthest distance vnder the earth, and especially at midnight) cause a mighty cold and chilling ayre: which the sun after his rising, vntill he be somewhat ascended aboue the earth cannot sodainly overcome and put away that cold impression of the ayre. So that the people there inhabiting, be monstrous of forme, and haue rude wits, wondrous wild and terrible conditions, like to wilde and furious beasts.

The countries which lie vnder the Southerly Parallels, as those which are described by the Equinotiall line, vnto the summer Tropicke, where the sun is drawne and runneth ouer the tops of them: there through the abundance of vapors, rayne, and night colde, is the suns heate repressed, mitigated, and dulled; so that the heades of the Ethiopians or Moores be litle, hauing but litle and withered braines, their bodies short, hauing thicke crisped haire on their heades, grosse and dull of senses, blacke scorched or burned bodies, withered or wrinkled faces, crooked of stature, being in a maner hot by nature, and cruell conditions, through the mightinesse of heat in those places. And the constitution also of the ayre is there such, that al liuing and cresent things on that earth, are found and known to agree with them. Further it is to be noted and vnderstood, that any there traouailing from the Northerly places, the further they goe towarde the South, so much the stronger heat or burning they shalbe annoyed with.

The two temperate zones be next adioining to the burning zone, the one on the Northerly, and the other on the Southerly side of it. And the beginnings of either bee the hotter, the ends colder, the middle of them exquisitly temperate: in the other parts doth the heat either so much the

more excede, or the bitter colde overcome them and ruleth, as howe much the nearer they approach or come vnto the burning Zone, or otherwise vnto either of the extreame Zones, which continually cause a bitter and an extreame colde.

The cause of this diuersity, is through the suns beames, for the sun continually moouing in the middle iourney of heauen (described betwene the two Tropicks) and digressing or going beyond the prescribed bounds of nature, doeth not shew his beames vnto diuers parts of the earth in one manner, but vnto the places right vnder, and in the burning zone the trades or countries contained vnder them, doth he send downe right beames, which stretcheth to the vpper face of the earth at right angles. And vnto the countries of either temperate zone, doeth the sun send downe thwart or slope beames. And vnto the places vnder either cold zone, doth he stretch long beames on the plaine of the earth, euen the like as being neare to the Horizon, which neither reach vnto the vpper face of the earth, nor cause angles, but keep an equall distance vnto it, do stretch forth infinitely.

But those beames of the sun doe neither giue light, nor heat, but turne backward: in that the property of the reflexion which of the beame against a solider resistance, prohibiting or letting the penetration, is a certaine repercussion and reuerberation) that increaseth and doubleth the force of the direct beame, and by the reflexed beame to it adioyned, or at the least by his vertue applied and communicated.

Seeing this reflexion is the especiallest cause of the heat and that the angles of the reflexions falling doe continually make or be equal in the angles: for that cause do they much vnlike increase the force of the direct beames, and their effectes doe notably varie. So that in the burning zone, the reflexion stretcheth vnto right angles, seeing the
 Straight

straight or right beames are caried & led into themselves, in such sort that as direct and reflexen, they meete and beemired, and in this, doubling as it were the vertue and force of the direct beames, is on such wise increased, that it kindleth, burneth, and consumeth.

And in either temperate zone, is the reflexion caused at right angles in that the sun beames doe thwartly reach to the vpper face of the earth, and are turned and extended backward vnto thwart angles, which how much the nearer and liker they bee to the right, so much the nearer doe they ioine either beames together: by which they proceed and come into the nearer parts of the burning zone. But so much the blunter as they stretch, so much the longer do they separte either beames, as howe much the more they are extended vnto the extreame or outmost bounds. And for this cause doe they more heat then the fore parts of the temperate zone, whose heate is a litle gentler or milder then the heate of the burning zone, and the beames a litle further of: whose colde notwithstanding differeth somewhat from the extreame or outmost vntemperate zones.

And those which stretch and fall into the middle region of either temperate zone, doe cause a meane betwene the right and very sharp angles, and yet not directly matched or ioined, nor doe they by so neare a space communicate their vertue, as in the beginning of it. neither by so large a distance as in the end, but in the middle in a manner: So that they cause and increase a temperate heate in the same zone.

But in the extreame or colde Zones, is no reflexion of beames caused. for those beames equally distant from the earth are stretched forth infinitely: and for that cause doe those neither giue light nor moue or procure heat, neither doe those zones at any time warme, either perfectly cleare, or appeare bright: but that they continually be foggy, misty, darke, and bitter or extreame cold, though the continuall

nuall mists, which more and more increase, especially toward the northerly pole. And yet many affirme, a reasonable dwelling in those places, yea and vnder the Northerly pole, but far colder and bitterer dwelling, though the far being from the way of the sun, and beholding of the comfortabler starres. For the Sunne though his ouer far distance, cannot by his presence about the earth comfort and heate.

This now is the perfect cause of the diuers and vniuersall constitutions of the ayre and chiefe qualities in each zones: so that of the particular constitutions be other causes. But to returne vnto the temperate Zones, the latitude of either temperate Zone is of 43. degrees almost, of Germane miles 645. and of furlongs 21500. So that the Bozeallo Northerly zone beginning from the Tropick of Cancer, endeth at the arcticke cyrcle, or at the degree of latitude 66. and 31. minutes. And the Southerly from the Tropicke of Capricorne, is extended or reacheth vnto the antarcticke cyrcle, or the degree of the Southerly latitude 66. and 32. minutes.

The vntemperate cold zones that reach frō either temperate vnto the poles of the worlde, doe mooue continuall cold and frosts. So that the beames of the sun, although they pearse and enter through, yet seeing they extende not backward, nor through the reflexion or streaching backward be strengthened and sharpened, therefore can they not so heate, that by the thawing they dissolue the earth and yse, nor put away or voyde the mist. Now the vntemperate Northerly zone, beginning from the 66. degree and 31. minutes of the Northerly latitude, endeth at the Pole arcticke: and the vntemperate southerly zone, begun from the same bounde of the Southerly latitude, extendeth and endeth at the pole antarcticke.

Those people which dwell vnder the burning zone, bee named of the Grekes *Amphiskioi* *Amphiscij*, in that the

Zone

Some shadowes, at diuers times of the yeare, goe or be cast to them twoe waies, as toward the South or North. And twise also in the year runneth the sun right ouer their heades (as is demonstrated in the second Theorime of Euclide) so that at some it cometh to passe, that they haue almost no shadow: for the sun being direct or in right line ouer their heades at some, hee then sendeth downe right Beames, which are cast or streached to the plaine of the earth at right angles: so that their shadowe falleth and is right vnder the fete, and not on any side of them. So that the sun in any other time of the yeare being without the verticall pointes, the shadowes at some are one whiles cast into the South, and another whiles into the North vnto them: euen as the sun digressing from their toppes or Pointed is either caried into the North, or otherwise declineth into the South.

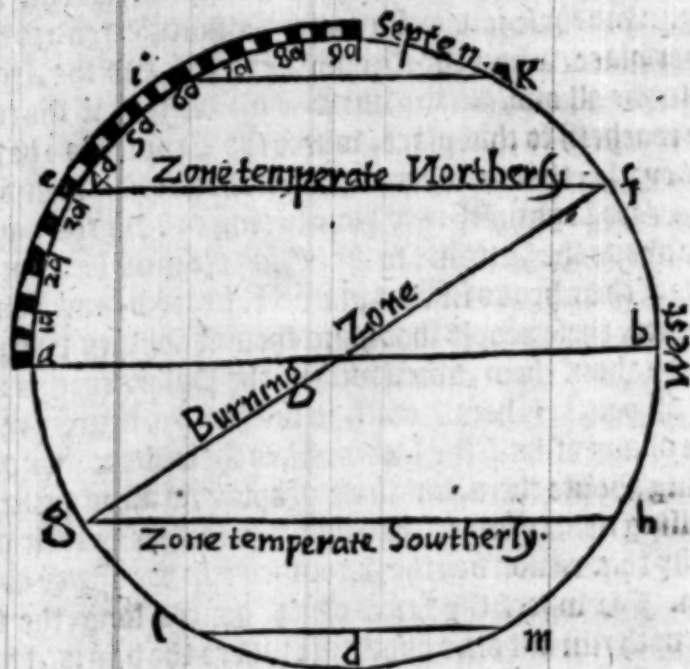
This sorte of people which bee vnder either temperate zone, are called of the Greeke Cosmographers *Eterofkioi*, *Heterofcij*, in that they haue a single shadowe. For with them the some shadowes continually run or goe toward one quarter onely. So that to them dwelling Northward the some shadow stretcheth toward the arcticke or Northernly quarter. By which it appeareth that the sun neuer ascendeth ouer their heades, but continually casteth or stretcheth his beames thwartly into those contries, which allwaies forme their thwart angles with the plaine of the earth, or els fall a-slope vpon the earth.

Those people which possesse, and dwel vnder either vntemperate or cold zones, are named of the Greeke writers *Perifkioi*, *Perifcij*: for that their shadowes in one artificiall day are caried and run rounde, as it were about them on the plaine of the earth: so that the sun vnto those places casteth or sendeth not straight, thwart, or slope, but long beames running on the horizons, which as they stretch along infinitely; euen so the shadowes going and lying on the

the flat of the earth, and extended along, doe increase infinitely. And these zones also vnder the poles, extend to that proper place, where the Tropicke cyrcles, and the Arctick cyrcles be all one. Strabo likewise writeth, that the colde zone reacheth to that place, where the Tropick is the arcticke cyrcle; that is, where this first Zone endeth, and the temperate beginneth: the Pole beeing 66. degrees, and a halfe aboue the horizon: so that this pole must be from the toppe of their heads in that place 23. degrees, and a halfe. Further, these people that haue their shadowes running rounde about them, dwell within the Polare cyrcles: In that all people whose Zenith is within 23. degrees and a halfe of any of both the Poles, haue their shadowes compassing aboute them, but those people (as afoze witten) dwelling nearer vnder the Pole, the longer is their day, and by that reason doe the shadowes run the oftner about them. For where the day is of 24. houres long, the shadow doth run but once about, yet where the day is of halfe a yeare long, the shadowes doe run 183. times about.

Here conceiue that there be five zones on earth, answering to the five celestiaall zones, both in the heat, temperatenesse, and cold: which for a plainer vnderstanding, vse this figure here following demonstrated. Where the Circle described on the plaine of the earth, is distributed by the two vnkknown diameters into foure equall partes: as to the outward points of the one diameter, note the letters a b. To the points of the other diameter, adde the letters c d. The letter c. the Northerly Pole, and the letter d. representing the Southerly pole. The arke of the Circle a c. deuide after the common maner into 90. parts or degrees, the number (as the vse is) noted by 5. 10. 15. 20. 25. &c. And beginning to reckon at the letter a. in ascending by the number 5, vnto the letter c. beeing the Northerly pole.

Further from the a. toward c. which demonstrateth the
suns



suns greatest declination, that containeth in our time 23.
 degrees, and 28. scruples, to the ende of the supputation
 adde the letter c. And by the office or use of the compasse,
 comprehend the arke a c. And by the foote also staying on
 a. reach with the other foot of the compasse opened toward
 d. the Southerly Pole, to which adde the letter g. After
 set (the compasse not yet varied) one foote on the pointe b.
 & with the other make a note or pricke toward c. to which
 ioyn e. and drawing the compasse againe make another
 point toward d. which betwene note the letter h. Again
 from the letter c. draw a straight line vnto f. which repre-
 senteth the Tropicke of Cancer. And from g. likewise
 drawe a line vnto h. representing the Tropicke of Capri-
 corne.

Again set one foote of the compasse unchanged on the
 letter

letter c. representing the Northerly Pole, and with the other opened, make a point of the one side, and after on the other side, in drawing a line besides from point to point, and the ends of that line note with the letters i k. that declare the articke cyrle. And likewise set one foete of the compasse on the note d. indicating the Southerly pole, and after the marking with points on either side, draw a right line; at the endes of which, note these letters l m. that represent the antarcticke cyrle.

These so finished, you shall then see on that plaine or flat the five earthly zones rightly described. For the space here represented of the earth by the Tropicke lines e f. and g h. included, both demonstrate the burning zone. In that the suns heat by his direct beams over it, both continually strongly heat and burne that space of the earth: wherefore you may rightly draw a straight line from the letter g. vn. to f. representing the suns iourney.

And the space of the earth included of the line i k. the articke cyrle, and the arke answering to the Northerly line i k. both indicate the cold and frozen zone Northerly. And that other Region or space contained right against, representing the antarcticke cyrle, both demonstrate the colde Southerly zone. And the tract or space of the earth included within the lines i k. and E F. both indicate our temperate zone Northward, and that reasonably habitable: and the other portion of the earth contained within the lines g h. and l m. both manifestly shew the temperate Southerly zone.

Where Ptholomie and other auncient Cosmographers write, that the burning zone is uninhabited, or as a desert, Aristotle, Plinie, and Iohn de sacro bosco (in his treatise of the Sphere) write the contrary: Besides these, it is well knowne at this day, yea by experience understood of those that haue yearely gone and come from the countries lying vnder that zone; that is, betwene the two Tropicks to be

inhabited. Further this burnt zone is inhabited and well replenished with people that there dwell, as the same is thoroughly known to many that haue passed to and fro the Indies: so that it may evidently appeare, that the heate there is not extreame, nor so distemperate, seeing the time of the heate that they suffer, continueth not long, nor the heat sharply worketh or causeth his uttermost effect. For the sun but a small time tarieth aboue the Horizon in the burnt Region or Zone (as certain astronomers write) as the space of twelue houres onely: so that the heat there is much qualified and suppressed, through the colde rising in the night time; whereof it is manifest, that he causeth not his extreame hotnesse there, although hee streacheth his beames perpendicularly on the earth. Therefore may many maruaile, that sundry ancient men affirme these parts to be vnhabitable, seeing they knew of Arabia, Fœlix, Aethiopia, Taprobana, and diuers other contries lying vnder the burnt zone: yea besides these, are Guineæ, Calicute, Muluca and Gatigara, well knowne to lie or bee vnder the burning Zone: and many of the people in those countries liue long: and the same Region also is inhabited and replenished well with people. A like affirmation hath Albertus and Auicen (as afoze witten) that the middle zone is habitable, for they agree contrary to the old writers, that in the same Region of the world, which the auncient Cosmographers named to bee the burnt Zone, that it is a far temperater dwelling, than vnder the Tropicks it can bee in any wise. And that people dwell vnder the Tropicks, the ancient neuer doubted. Wherefore if so resonable dwelling be vnder the Tropicks, it cannot be otherwise (as affirmeth Petrus de apono) that vnder the Equatoure, (notwithstanding the sunnes sharpe heate) but that men may dwell there for all the vntemperatnesse of heate. To bee brieife, al the writers of later yeares agree, that the middle zone is not onely habitable, but found and known by many

my reasons, and by experience, that the same is most temperate, and the earth vnder it rich, both of golde and rich drugges, and reasonable well furnished of all things needfull for mans life. So that in the same middle Region of the earth vnder the Equatour, it appeareth, that though the coldnesse of the night, it doth there temper sufficiently the burning heat of the day. Besides these, after the mind of Hiero. Cardane, in that Saturne, Mercurie, and the moon (which properly are cold and moist planets) haue a great force in the Regions vnder this zone, but especially the moon, that worketh her most force there in the night time, more then the other twoe: and of this cause more temperatnesse in the day time. Besides these, it is well known that those people haue two summers, and two winters in the yeare. For in the yeare of our Lord 1530. at the will and charge of Charles the first Emperour, a parte of America westward was discovered, where Peru among the rest, was found richest both of Gold and other rich things and costly drugges, which is situated in longitude, of 290. degrees from the West toward the East, and is distant 5. degrees from the Equatoure toward the South. But what substance of Gold and other rich things hath yearely bene brought from this yle, needeth not here any further rehearsal. And the like is to be considered and noted of the other two zones, contained betwene the Polare cyrcles, and Poles of the worlde. Although Albertus Mag. denieth, a commodious dwelling for men in those places, and confirmeth the same by probable reasons, yet experience reclaimeth and denieth those opinions of his, and other ancient writers. In that it is well knowne that Gothland, Norway, Russia, Lapeland, Groueland, and diuers other countries toward the North pole, is inhabited and well peopled. And Galeottus Naruiensis proueth, that men dwell vnder the North pole, affirming the same not to bee true, that the cause of the cold there is onely the far distaunce of

the sun, as not of the heate by nearenesse of his comming. In that the sun by reason of the signe in which he is, either increaseth or diminisheth them with vs. Besides he affirmeth, that the colde is not so dispersed rounde about, as that it compasseth rounde after the forme of a cyrcle, nor that the heate in like sort doeth run round about the whole body of the earth. Further Cardane writeth, that vnder the poles, there is no such colones as some suppose, in that the Moone, Venus, and Mars haue the greatest latitudes, in respect of the sun, and the others besides. For the moon hath five degrees to the North, Venus and Mars exceed vnto eight degrees Northward, but Saturne which is the author of cold, scarcely performeth three degrees Northward. Besides these, the Moone more auaieth Northward and Southward neare to the poles, then the sunne, in that she nearer approacheth those parts. For the Moone (as aboue said) hath five degrees of latitude: as well to the North, as South: so that when she shall be in the first degree of Cancer, with her greatest latitude Northward; that is, in the head of the Dragon, she shall then be nearer by five degrees to the Northerly pole, then the sunne. And in like maner, when she shall be in the taile of the Dragon (at the entrance and beginning of Capricorne) she shall bee nearer the pole antarcticke by five degrees than the sun. Although in the winter the moone should be in the beginning of Capricorn with the Southerly latitude of foure or five degrees, yet may she worke and cause more in the change of weather, and shall cause more in Scotland than the sun, in that her power and vertue there is such. But in Brasilia and vnder the antarcticke pole for two causes, the one, in that shee is there of such power, and the other for that in her working she is nearer.

What

What the longitudes and latitudes of the celestiall Zones are.



The longitude of Zones beginneth from the West, and is extended by the Sonnesteede into the East, and from the East againe by the midnight pointe into the West. The motions of the sun in the zodiacke, and Poles of the zodiacke, doe describe the latitude of the zones. For the suns motion oꝝ the zodiacke do describe the burnt zone, seeing the sun on the one parte of the zodiacke goeth toward the North vnto the elongation of 23. degrees, 28. minutes, and being by his dayly motion in the beginning of Cancer, doth describe the Tropick of Cancer, which is the bound of the two zones, the burnt zone, and Northerly temperate Zone. And on the other part of the zodiacke doeth the sun goe into the South vnto the same elongation, and being in the beginning of Capricorne, doth likewise describe the Tropicke of Capricorne, which is the bounde of the other twoe zones: in that it distinguisheth the burnt from the southerly temperate zone. And the space also included in these two cyrcles, vnto the middle place, is called the burnt zone, and thus the burnt zone, doth imploy 46. degrees, and 57. minutes.

The Poles of the Zodiacke (which are dayly about the Poles of the worlde) from which they differ 23. degrees, and 28. minutes, and are drawn by the motion of the first mouer, doe describe two cyrcles in the diuers parts of heauen as the Polare cyrcles, which also be the bounds of the zones, that distinguish the twoe temperate from the colde zones. So that the latitude of either colde zone, vnto the

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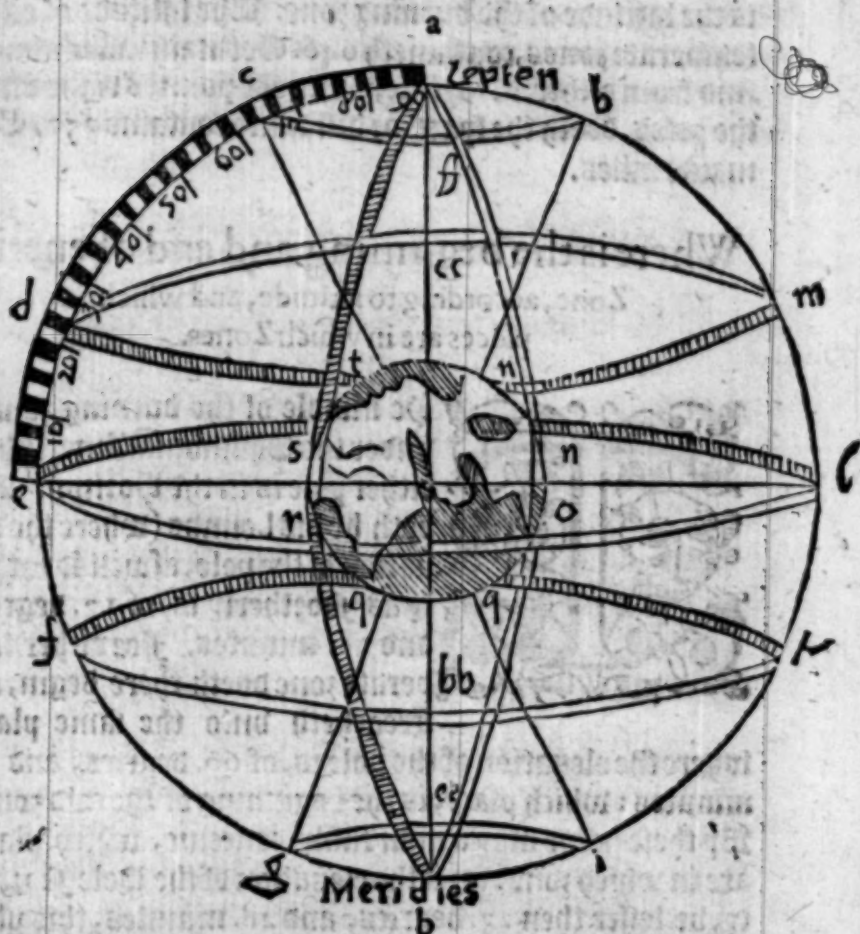
poles

poles of the world, is of 23. degrees, and 28. minutes. The other degrees of the semicycle are attributed to the temperate zones; so that either zone containeth 43. degrees, and 3. minutes.

What is the Longitude and Latitude of the earthly Zones.



The longitude of the earthly zones, is like to the longitude of the celestiall, as from the West by the noon steed into the East, and from thence by the midnight pointe againe into the West. And the latitude of them is like to the latitude of the celestiall zones: so; as the maner of the latitude of the celestiall burnt Zone is vnto the whole cyrcumference; euen so is the maner of the earthly burnt zone, vnto the compasse about of the earthly Globe; that is, as 47. degrees is vnto 360. and so likewise conceiue of the others. And that this may plainer appeare, vse the figure following, in which a h e. is the meridian, o. Colure of the solstices, e x l. the Equatoure, a x h. the meridian, s u p. the earthly Globe, s n. the earthly Tropicke of Cancer, k o. the Tropicke of Capricorne t u. and q p. the arcticke cyrcles. To these answer fro k b b. and d s m c c. also c f f b a g e e i. the celestiall cyrcles. And what the proportion f d. is, vnto the whole copasse d a k g f the same is (as aboue written) the proportion r s. vnto the whole cyrcumference of the earthly Globe: and on this wise conceiue of the other cyrcles. The letters f d. bee the latitude of the celestiall burnt zone, and r s. of the earthly, d c. and f g. be the latitudes of the temperate zones in heauen, and s t a c r q. of them on earth. The two outward zones,



zones, to these here drawne, bee by themselves noted, as well in heauen, as on earth.

Now that wee haue declared with the five cyrcles, the latitudes either of the celestiaall or terrestriall zones are defined, it shall therefore be necessary to write here of the latitudes of the earthly zones in miles. And that you may readily find the latitude in miles, multiply the degrees by 15. (in that so many Germane miles, answere to one degree of the great cyrcle in heauen) as the 43. degrees of the burnt zone, being the suns greatest declination, multiplied by the 15. miles, doe produce 705. German miles, which

is

is the latitude of the burning zone. The latitude of either temperate zones, containeth 646. German miles almost. And from either Tropicke, vnto the pointes right vnder the poles, doeth the space or distaunce containe 352. German miles.

Where is the beginning and end of euerie
Zone, according to latitude, and which
places are in which Zones.



The middle of the burning zone is vnder the Equinotiall line, where either pole is in the Horizon. And both be his bounds (where the eleuation of the pole, aswell Southerly as Northerly is) of 13. degrees, and 28. minutes. For either temperate zone doeth there begin, and stretcheth vnto the same place, where the eleuation of the pole is, of 66. degrees, and 30. minutes: which place, is the beginning of the cold zones. By these nowe may a man easily conceiue, which places are in which zone: for if the eleuation of the Pole Northerly, be lesser then 23. degrees, and 28. minutes, this place then is in the burning zone, as the inner Libia, Aethiopia, a part of Arabia Felix, and India. But if the eleuation containeth precisely so many degrees and minutes, the place then is in the bounde of the burnt and temperate zone; as is Siene a city of Aegypt. Further if the eleuation of the Northerly Pole bee greater then 23. degrees, and 28. minutes, yet lesser then 66. degrees, and 30. minutes, this place the is in the temperate zone, as Greece, Italy, Spaine, Germanie, France, England &c. But if the latitude be precisely of 66 degrees, and 30. minutes, the place is in the bound of the temperate and cold zone, as is almost Lagen-lacus.

lacus of Suetia. Last, if the elevation of the pole exceedeth 66. degrees, and 30. minutes, the place is in the cold zone beyond which degrees hath Nicolaus Douis a Germaine added a table of Noreway, Gothland, Ileland, Greenland, Fineland, and Lapeland &c.

How the Zones and Cli mats doe differ.



The Zone is a space or roome of the earth, frō the West into the East, and from thence by the midnight pointe againe into the West. But the Clymate is a space of the earth, whose beginning is constituted in the west and ende in the East. A Zone also is the space of earth, betwēne two cyrcles equidistant, but a Climate is the only space or roome of the habitable earth, contained betwēne two lines equidistant.

What the qualities of the Zones are.

The celestiaall Zones are qualities attributed, not formally, but onely vertually; that is, the celestiaall zones are neither cold, hot, nor temperate, but of this named colde, burning, and temperate, through the sunne, which one whiles comming into this, and another whiles declining into that parte of the worlde, doeth send downe his beames to the earth in sundry maner: as one whiles plum downe right, when the sun runneth vnder the equinoctiaall, and another whiles by a thwart maner, as in the thwart sphere: which beames (besides how right angles they make on earth) so much the greater heate they cause. and how thwart angles they make, somuch the weaker heat they procure. So that vnder the Equinoctiaall the beames most rightly and downe right falling, doe make right angles on the vpper face of the earth, which through the same causeth a most great heat. Also the beames falling

toward either poles, doe cause thwarter angles, and they make the angles moze vneuen oꝛ thwarter, and therof the same heat is the lesser. And in the temperate zone (especially in the summer) the beames doe make almost angles falling vnto a rightnes, but in the winter vnto a thwartnes; so that in the same Region is a comodious dwelling. But in the colde zones the angles are caused unlike oꝛ vneuen, & thwartest oꝛ slopest, as in the burnt Zone they are rightest and most downward: in somuch that the cold zones euen (as the burnt) are commodious to dwell vnder. For the beames falling and reflexed, how much nērer they fall and be together, somuch the stronger and mightier they moue and cause the heat: as we dayly see that the sun in the noon, stand being (as in the summer) to cast oꝛ stretch downe almost perpendicular oꝛ down right beames: which beames also are almost reflected into themselves, of which the greatest heat of the day then is caused. And contrariwise, the sun being in the East oꝛ west, where he beames stretching downward and reflexed, are scatred and run abroade; the effects be lesser, and the heat much abated and feebled. Euen so the beames in the burnt zone bee perpendicular oꝛ plum downright, which reflexed into themselves do cause a most great heat. In the temperate zone doe the beames by little and little fall sloper and sloper, of which they cause there a temperate heat. But in the cold zones the beames furthest decline oꝛ fall slopest, through which they procure no effect, & of the consequent cause there a very weake heat.

What the vtilities of the Zones be.

¹ **T**he auncient considerers of the stars, haue thus instituted the distribution of the zones for two causes. The one is, that by this reason they might shewe to vs which places of the earth be reasonably habitable, & most commodious to dwell vnder.

² The other is (as wee learne by experience) that the
wits

twits of men, and nature of places by them appeare and are knowne, in that the ayre compassing vs, is a certaine cause of the temperatnes. For the maners and condicions of men (as writeth Galen) doe for the most parte ensue the temperaments of the bodies: yea the nature of trees, plants, hearbs, and beasts do like ensue the temperament of ayre. Of which that we might bee the surer and certainer of the natures of the foresaid matter, it pleased the ancient to deuide them into five zones. Of which (it is wel known) that the bodies of men or people dwelling vnder the burning zone (as the Moores) be shorter of stature, the those people dwelling vnder the temperate zones, wilder, and crueller. Also they bee crafty and subtil of nature, hauing besides wrinkled faces, thicke crisped heare on the head, and blacke scorched bodies, and crooked of stature. Also all liuing and cresent things, are found to agree according to the quality of the ayre in that Region. Further the people dwelling vnder the Northerly Parallels or Polare cyrcles (where the places bound of colde and moisture) be white of body, hauing long heare on the head, tall and comely of stature and personage, cold of qualitie, yet in maners or condicions wilde and cruell, through the force of the cold in those places, and agreeing with these is the greatnes of the winter, and the greatnesse of fierce and cruel beasts, and other liuing things there breeding, with a furious people inhabiting, called generally the Scythians. Last, those dwelling vnder the temperate zones, be a gentler and ciuiler people beeing some tawnie (especially toward the South) and others toward the North reasonable white of skin and body, being meane of stature, and temperate in nature and quality, and of the same like in condicions and behauior, &c. And thus much, for the second part of this Treatise.

FINIS.

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seuerall points handled in
this Booke.*

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